



STRATEGIES AND ACTIONS TO RECOVER
PUGET SOUND TO HEALTH

C: REDUCE AND CONTROL
THE SOURCES OF POLLUTION
TO PUGET SOUND

Reduce and Control the Sources of Pollution to Puget Sound

Reducing and controlling the sources of pollution to Puget Sound is of paramount importance to the long-term health of the Puget Sound ecosystem and its residents. Human and animal wastes, fertilizers, pesticides, and the toxic chemicals that run off pavement during storms and are discharged from industrial facilities can enter the water and harm aquatic life, and also pose several health and safety problems to humans. A successful approach to pollution in Puget Sound must ensure that toxics in marine waters and sediments, and in mammals, fish, birds, shellfish and plants, do not harm the persistence of these species; urban stormwater runoff, as well as agricultural and forest runoff, is effectively controlled and managed in an integrated way; loadings of toxics, nutrients, and pathogens do not exceed levels consistent with healthy ecosystem function; shellfish populations are healthy and abundant; the threat and severity of oil-spills is minimized; and our legacy of pollution impacts in Puget Sound are addressed and cleaned up.

This chapter describes nine overarching strategies that are essential to reduce and control the sources of pollution to Puget Sound:

- **C1** – Prevent, reduce, and control the sources of toxic contaminants entering Puget Sound;
- **C2** – Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales;
- **C3** – Prevent, reduce, and control Agricultural runoff;
- **C4** – Surface Prevent, reduce, and control surface runoff from forest lands;
- **C5** – Prevent, reduce, and/or eliminate pollution from decentralized wastewater treatment systems;
- **C6** – Prevent, reduce, and/or eliminate pollution from centralized wastewater systems;
- **C7** – Abundant, healthy shellfish for ecosystem health and for commercial, subsistence, and recreational harvest consistent with ecosystem protection;
- **C8** – Effectively prevent, plan for, and respond to oil spills;
- **C9** – Address and clean up cumulative water pollution impacts in Puget Sound.

The 2020 ecosystem recovery targets most related to reducing and controlling the sources of pollution are: freshwater water quality; marine sediment quality; toxics in fish; insects in small streams; dissolved oxygen in Puget Sound; management of on-site sewage systems; swimming beaches; shellfish bed recovery.

Prevent, Reduce, and Control the Sources of Contaminants Entering Puget Sound

The Challenge

For decades, humans have released toxic chemicals, nutrients, and pathogens into Puget Sound and its watersheds through a variety of activities. Concerns about the possible harmful effects of these contaminants led to the creation of Washington's Pollution Control Commission in 1945, almost 30 years before the federal Clean Water Act, as well as the Puget Sound Water Quality Authority in 1985. While these and other federal and state efforts have been important at addressing threats to water quality, many sources continue to release contaminants to the water, air, and lands of the Puget Sound basin.

Contaminants of concern for Puget Sound include excess nutrients, pathogens, sediments, and toxic chemicals. Human-caused releases of excess nutrients, pathogens, and sediments can harm aquatic life and the human uses of fresh and marine waters. A number of toxic chemicals used by humans (e.g., pesticides, industrial chemicals) are released to the Puget Sound environment where they harm or threaten harm to biota and humans. Among toxic chemicals, persistent, bioaccumulative, toxic (PBT) chemicals raise special challenges because they remain in the environment for a long time and accumulate in people and in the food chain. They also can travel long distances and generally move easily between air, land and water. Prevention is especially important for PBT chemicals, since they can remain in the environment and continue to harm wildlife. One example is PCBs, which were banned more than 30 years ago, but remain in the environment and continue to harm wildlife and people. An effective way to reduce and control problems from all types of pollution is to prevent the initial release of contaminants to the environment.

In 2007, Washington became the first state in the country to ban specific polybrominated diphenyl ethers (PBDEs) because of human health and environmental concerns. More recently, Washington State enacted laws banning the use of bisphenol A (BPA) in children's bottles and other containers, banning the use of lead wheel weights to balance tires, and restricting the amount of copper in vehicle brake pads. Starting in 2012, manufacturers of children's products in Washington will be required to report to Ecology if their products contain chemicals on a list of chemicals of high concern to children, under the Children's Safe Products Act (CSPA).

PUGET SOUND TOXICS ASSESSMENT

In 2011, the Department of Ecology, in coordination with PSP and other organizations, completed a multi-year study of toxic chemicals in Puget Sound. The 17 chemicals evaluated in this study were selected based on the threat or known harm to biota, the broad range of conveyance pathways, and the availability of monitoring data. These chemicals of concern include metals, petroleum, persistent bioaccumulative toxic (PBT) chemicals such as PCBs, and contaminants of emerging concern, including endocrine disrupting compounds. Of the 17 chemicals, only five have been restricted nation-wide under the federal Toxics Substances Control Act (TSCA). Additional contaminants of emerging concern, such as those from pharmaceutical waste, personal care products, and plastic pollution, may also be important toxic threats to Puget Sound, although much less is known about the exposures and effects of those contaminants in Puget Sound.

The Puget Sound Toxics Assessment found that:

- Levels of copper, mercury, PCBs, PBDEs, dioxins and furans, DDT and related compounds, and PAHs occur at levels in the Puget Sound basin associated with documented or potential adverse effects to a variety of aquatic organisms.
- Sources of toxics are varied and include vehicles, pesticides, industrial air emissions, combustion emissions, and leaching or off-gassing of toxics from products in the environment. Industrial, commercial, and institutional point sources do not account for the largest releases of toxic chemicals; a variety of diffuse sources account for the majority of toxic chemical releases.
- Runoff and leaching from roofing materials appears to be a large source of release of metals
- Vehicle-related releases – from wear of vehicle components, combustion of fuel, and leaks of motor oil and fuel – contribute large amounts of a variety of contaminants (e.g., copper, zinc, PAHs, dioxins and furans)
- Toxic chemicals move into Puget Sound aquatic habitats through numerous pathways, including surface runoff, air deposition, discharges from industrial sources and wastewater treatment plants, groundwater discharges, CSOs, spills, contaminated sediments, exchange with oceanic waters, and biological transport.
- Surface runoff or stormwater is the primary way that many of the contaminants evaluated in this study enter Puget Sound. Runoff from commercial/industrial lands typically has the highest concentrations. Due to the large of forests in the Puget Sound basin, considerable loads of contaminants are delivered to aquatic environments in runoff from forest-covered lands.
- Atmospheric deposition of contaminants to surface waters is an important loading pathway for PBDEs and some PAHs.

The assessment concludes that:

- Priorities for source control actions should focus on copper, PAHs, bis(ethylhexyl)phthalate, and petroleum
- High priority should be given to implementing control strategies to prevent the initial release of contaminants
- Source control strategies should focus on reducing or treating stormwater inputs, especially identifying and controlling contaminant releases from existing and new developments
- Source control strategies should be developed around reducing contaminant inputs from vehicles
- Field investigations should be conducted to improve information about runoff and leaching from roofing materials

For more information see Ecology reports:

- *Assessment of Selected Toxic Chemicals in the Puget Sound Basin, 2007-2011* (Publication No. 11-03-055)
 - *Primary Sources of Selected Toxic Chemicals and Quantities Released in the Puget Sound Basin* (Publication No. 11-03-024)
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This strategy is focused on source-reduction efforts to keep chemicals and other contaminants from being used or generated in the Puget Sound region or released to the Puget Sound environment. This strategy includes reducing and restricting the use of toxic chemicals, controlling initial releases of contaminants to the Puget Sound environment, and improving how businesses and other entities use and manage chemicals and other contaminants through technical assistance, education, inspections, and targeted enforcement efforts. Other strategies in Priority C deal with efforts to control specific pathways of delivery, such as wastewater and stormwater pollution, and to clean up areas where pollution has occurred. For instance, while this strategy includes approaches for reduced releases of contaminants to wastewater treatment plants, much of what we think of as wastewater controls is presented in strategies C5 and C6. Similarly, controlling sources contaminants to reduce the levels of pollution entrained in stormwater and surface runoff is addressed in this strategy but other aspects of management of urban stormwater and runoff from agricultural and forest lands are presented in strategies C2, C3, and C4.

Sub-strategies and actions to reduce the release of contaminants to the Puget Sound environment include governmental and non-governmental actions to implement and strengthen authorities and programs to prevent chemical releases to the Puget Sound environment; adopt and implement plans and control strategies to address air pollutant emissions and discharges from vessels; increase compliance with and enforcement of environmental laws and standards; develop safer alternatives to chemicals; and provide education and technical assistance.

Climate Change

Climate change impacts on precipitation timing including seasonal streamflow, more severe winter flooding, and more frequent and extreme storm events, will likely increase runoff from stormwater. Preventing, reducing, and controlling contaminants before they reach land and water is important part of preparing for this increase in runoff.

Contaminant related strategies and actions are generally addressed in *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy (April 2012)* in the priority strategies to reduce the vulnerability of coastal communities, habitat and species, as well as those to address stormwater covered in Action Agenda Section C2.

Relationship to Recovery Targets

Preventing the introduction or release of contaminants to the water, air, and lands of the Puget Sound basin is essential to achieving several recovery targets. These include ensuring that by 2020, the levels of specific toxic chemicals, including PCBs, PDBEs, and polycyclic aromatic hydrocarbons (PAHs), and other endocrine-disrupting compounds, are below threshold levels in fish tested in Puget Sound; marine sediments in Puget Sound bays and regions show minimal impacts from toxic chemicals in marine sediment quality indicators; shellfish beds are restored for harvest; and swimming beaches are safe for swimming (meet standards). These strategies also help achieve other recovery targets, including decreasing the number of impaired freshwater bodies, improving the average benthic invertebrate index scores of 30 lowland watersheds from "fair" to "good," and other water quality improvements to achieve by 2020.

Local Priorities

Local Integrating Organization	Priorities
South Central	<i>Top Priority</i> <ul style="list-style-type: none">Keep toxics and excess nutrients out of stormwater runoff and wastewater.
Strait of Juan de Fuca	<i>From 19 Strategic Priorities</i> <ul style="list-style-type: none">Toxic Source Reduction Programs - Improve, develop, and implement toxics source reduction programs and projects
Stillaguamish-Snohomish Watersheds, Island Watershed and Skagit Watershed	The importance of controlling toxics has been discussed as potential strategy in these three areas.

C1. Prevent, reduce, and control the sources of contaminants entering Puget Sound

C1.1 Implement and strengthen authorities and programs to prevent toxic chemicals from entering the Puget Sound environment.

Based on a priority of EPA Administrator Lisa Jackson, EPA has announced plans to reauthorize TSCA to reform and strengthen the effectiveness of the nation's chemical management legislation. Ecology, environmental agencies from other states, and various NGOs are involved in the TSCA-reform efforts. EPA is also implementing a Phthalates Action Plan, which includes issuing rulemakings under TSCA by 2012 to regulate eight phthalates. Ultimately, keeping toxic substances out of our waters will require more effective federal legislation. Until TSCA and other federal statutes are updated, states need to continue to address chemicals of concern.

Ecology has a Reducing Toxic Threats initiative that aims to prevent the use of toxic chemicals, assist businesses to reduce or manage the amount of toxic chemicals that enter the environment, and clean up toxics that have polluted the air, land, or water. Key focus areas include reducing the use of toxics in products and preventing toxics from entering stormwater. In its efforts to reduce and help phase out PBT chemicals, Ecology develops Chemical Action Plans (CAPs), which identify, characterize, and evaluate all uses and releases of a specific toxic chemical, and then recommend actions to protect human health and the environment. Past CAPs have addressed lead, mercury, and PBDEs. Ecology began focusing specifically on PAHs in 2010 as part of the Puget Sound Toxic Loading Study and plans to complete a CAP for PAHs by 2012. Results from the Puget Sound loading analysis identify wood smoke, creosote-treated lumber, and vehicle emissions as the largest sources of PAHs in Puget Sound.

These federal and state toxics control programs are complemented by an array of toxics reduction initiatives of local hazardous waste programs and environmental organizations such as the Washington Toxics Coalition and People for Puget Sound. These efforts are further discussed in the technical assistance and education sub-strategy below, C1.4. To be fully effective, federal, state, and local entities in the U.S. will also need to collaborate with Environment Canada to address transboundary sources of toxic contaminants in Puget Sound. This sub-strategy helps reduce the release of toxic chemicals to the

Puget Sound environment by continuing and enhancing programs that prevent the release of chemicals. Based on the priorities of Ecology's Reducing Toxic Threats Initiative and the findings of the Puget Sound Toxics Assessment, the near-term actions in this sub-strategy focus on preventing pollution that enters Puget Sound from a few key sources: vehicles, pesticides, and toxic pollutants in air emissions (also discussed in C1.3). Actions to address pesticide use are covered here and under the agricultural runoff strategy (C3). The Department of Ecology and its partners are specifically focusing in the near term on addressing chemicals of concern in Puget Sound as evaluated in the Puget Sound toxics assessment. However, it will also be important to better understand and characterize any potential threats to Puget Sound from contaminants of emerging concern, such as pharmaceuticals, personal care products, and micro-plastics, and then develop appropriate toxic-reduction strategies to address the most important problems.

Ongoing Programs

Over the next few years, Ecology's Reducing Toxics Threats Initiative plans to support congressional reform of TSCA, develop rules by December 1, 2012 to implement the state law relating to brake friction material, complete and implement the CAP for PAHs, establish a mercury lamp product stewardship program, and complete a CAP for PFOS (perfluorooctane sulfonate, a PBT chemical). Key performance metrics in evaluating the success of toxics efforts include the number and volume of chemicals of high concern to children replaced with safer alternatives and reduced environmental levels of toxics in fish, the primary exposure route to humans through consumption. Statewide, Ecology also has an overall target of reducing the amount of hazardous materials used by 2 percent per year, and a specific target of collecting or capturing an additional 1,500 pounds of mercury over 2011–2013. Ecology has been awarded a Toxics and Nutrient Grant from EPA's National Estuary Program, which provides funding for toxics reduction efforts in Puget Sound. This grant can be used to help implement near-term actions identified in the Action Agenda to reduce toxic threats.

Key Ongoing Program Activities

- By December 1, 2012, Ecology will develop rules to implement the state law relating to limiting copper used in vehicle brake friction material and will track the pounds/year of copper reduced. Brake pads and shoes manufactured after January 1, 2015, must not contain asbestos, lead, cadmium, mercury, or chrome (VI). Brakes manufactured after this date must also be marked to indicate the amount of copper they contain.
- The auto shred task force chartered by Ecology will issue its recommendations regarding how to reduce the amount of toxic chemicals present in all shred residue from shredding automobiles and other metal objects by 2012. In 2013, Ecology will begin implementation of the recommendations for an all shred residue program to reduce the amount of toxic chemicals in shred residue.
- After the completion of the PFOS CAP in 2013, Ecology will review the PBT list and prioritize the next PBTs for CAPs with a multi-year schedule. Ecology will also determine if it is necessary to revise the PBT Rule to update the list of PBTs. Rulemaking would be required if revisions are needed.

Near-Term Actions

C1.1 NTA 1: [PAH and PFOS Chemical Action Plans](#). Ecology, working with its partners, will complete a PAH CAP by 2012 and a CAP for PFOS or all perfluorinated compounds (PFCs) by

2014, and begin to implement the recommendations from the Plans. (Wood smoke actions in the PAH CAP will build from the control strategies outlined in the Tacoma SIP for fine particulates. The PAH CAP may also include recommendations to reduce PAHs from incomplete combustion and/or other sources. The PFOS/ PFC CAP will include an evaluation of safer alternatives and recommendations for reducing use of PFOS and/or PFCs.)

Performance measure: PAH and PFOS or PFC chemical action plans completed or not; pounds/year of PAH reduced.

C1.1 NTA 2: Mercury Lamp Product Stewardship. Ecology will establish a mercury lamp product stewardship program by 2013.

Performance measure: Program established or not; pounds per year of mercury collected.



C1.1 NTA 3: Fish Consumption Rates and Management Standards. In 2012 Ecology will propose draft rule language that will address human health; protect ecological receptors from bioaccumulation; and include freshwater sediment standards and develop Implementation Tools for meeting Water Quality Standards based on revised human health criteria. Ecology worked with an external advisory group on developing preliminary concepts for rule updates; tribes, stakeholders, and the public reviewed a draft technical support document on fish consumption rates; this input is being considered for rule updates. In 2012 Ecology will propose draft rule language that will address human health and background; protect ecological receptors from bioaccumulation; and include freshwater sediment standards. Rulemaking also continues to develop Implementation Tools for meeting Water Quality Standards in anticipation of future updates to water quality standards based on revised human health criteria.

Performance measure: Complete by June 30, 2013.

C1.1 NTA 4: Estimates of Copper in Pesticides. The Washington Department of Agriculture will work with Ecology to review and refine estimates of the agricultural and non-agricultural release of copper from pesticide use in the Puget Sound basin and publish a summary report by December 2012. This report is one element as part of a process to evaluate copper loading in Puget Sound.

Performance measure: By December 2012, WSDA publishes a report describing opportunities to refine estimates of agricultural and non-agricultural release of copper from pesticide use in the Puget Sound basin. This will involve evaluating the 2004 report completed for the San Francisco Bay estuary, reviewing the assumptions used in the Puget Sound loading study, assessing changes in registration status of copper containing pesticides, and comparing and contrasting use patterns in Washington and California. Copper release information is used to evaluate surface water monitoring data collected in 2012.

C1.1 NTA 5: Pesticide Use Survey. By December 2013, Washington Department of Agriculture, in partnership with the USDA National Agricultural Statistics Service and coordination with PSP, will complete survey work and publish a report of refined estimates of primary releases of copper from non-agricultural pesticide use in the Puget Sound basin. This includes conducting a pesticide use survey of homeowners within the Puget Sound basin. In addition, WSDA will survey commercial and public applicators to provide a more complete profile of urban pesticide use. The results will be used to further refine the estimates for urban pesticide use (including copper compounds) as a source of toxic chemicals released to the Puget Sound environment. This work is one element as part of a process to evaluate copper loading in Puget Sound.

Performance measure: By November 2012, survey drafted and distributed to 9500 homeowners. Report produced by December 2013. Discuss findings and next steps with the Leadership Council by March 2013. Copper use information is used to evaluate surface water monitoring data collected in 2012.

C1.1 NTA 6: Emerging Contaminants. Ecology and PSP will assemble information on chemicals of emerging concern, beyond the 17 chemicals of concern in the Puget Sound Toxics Loading Studies, including PBTs, endocrine disruptors, other chemicals, and nanotechnology and nanomaterials, and will recommend actions to (1) better understand the threats to Puget Sound and (2) address the highest priority problems.

Performance measure: By December 2013, Ecology will publish recommendations for actions to understand and address emerging contaminants.

C1.1 NTA 7: Water Quality Enforcement. (Owner needs to be identified) Increase the capacity for enforcement, and enforce all regulations pertaining to the discharge of pathogens and contaminants to the waters of the state to ensure achievement of approved shellfish growing water certification.

Performance measure: To be determined.

Comment [KG5]: Proposed by Shellfish subcommittee

In addition, actions related to removal of creosote pilings and derelict vessels are described in B3.

C1.2 Promote the development and use of safer alternatives to toxic chemicals.

Governmental and non-governmental green chemistry and green design initiatives such as EPA's Design for Environment Program help evaluate and promote products and process alternatives that are cost effective and safer for the environment. Green chemistry refers to the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green design or Design for Environment refers to an approach for designing products or processes that minimizes negative environmental impacts throughout the life cycle of the product; often this includes replacing toxic material inputs with less toxic or non-toxic alternatives. This sub-strategy complements the sub-strategies focused on reducing the use of toxic chemicals through regulations, enforcement, technical assistance, and education by ensuring that safer alternatives to problem chemicals, formulations, and/or products are available for businesses and consumers to use.

Ongoing Programs

Activities to support the development and use of safer alternatives to toxic chemicals include developing new alternatives through green chemistry approaches, conducting assessments of alternatives, and providing guidance and training to assist organizations with their efforts to find safer alternatives. Ecology's Reducing Toxic Threats Initiative has identified several priority activities related to spurring the development of safer alternatives to toxics for 2011–13 and beyond, including:

- *Strategy Development:* Create a green chemistry roundtable "roadmap" for the state and implement recommendations, including establishing a green chemistry center.
- *Guidance Development:* Work with certain member states of the Interstate Chemicals Clearinghouse (IC2) to develop a chemical alternative assessment guidance document. Ecology also plans to develop a case study portfolio.
- *Alternatives Assessment:* Perform an assessment of five chemicals to identify safer alternatives (if grant funding is received).
- *Education and Training:* Train businesses on GreenScreen™ Version 1.2 (a tool to help businesses to evaluate the toxicity of various chemicals), train staff on a Quick Chemical Assessment Tool (a tool based upon the GreenScreen™ to evaluate alternatives to toxic chemicals), and conduct a green chemistry workshop for high school teachers.

Overall, by reducing toxic chemicals in products and promoting safer alternatives, Ecology aims to achieve the following statewide, quantitative performance targets:

- Reduce the annual pounds of hazardous materials used by two percent per year.
- Collect/capture an additional 1,500 pounds of mercury in FY2012–FY2013.

As part of its Phthalates Action Plan, EPA intends to conduct a Design for Environment and Green Chemistry alternatives assessment by 2012 to assist with phthalate rulemakings under TSCA and the identification of safer alternatives. EPA's alternative assessment will present data on the hazards associated with the eight phthalates found in Ecology's list of chemicals of high concern to children.

Key Ongoing Program Activity

- The EPA Design for Environment Program will complete an assessment of alternatives to commercial uses of phthalates in 2012 as part of its Phthalates Action Plan. By 2013, Ecology will interpret the data provided in EPA's phthalate alternative assessment, as well as other sources, and recommend alternative(s) to phthalates in specific applications. Ecology will also incorporate the information on safer alternatives into its guidance materials and technical assistance efforts and recommend and take actions to reduce phthalates entering Puget Sound. Future efforts will incorporate the recommendations of the Sediment Phthalate Workgroup, which provided recommendations on sediment recontaminated by phthalates in stormwater.

Near-Term Actions

C1.2 NTA 1: Chemical Alternatives Assessments. By 2013, Ecology will work with the Interstate Chemicals Clearinghouse (IC2) to develop a guidance document on chemical alternatives assessment and, depending on funding availability, will complete assessments of five chemicals to identify safer alternatives.

Performance measure: Draft guidance document issued in September 2012.

C1.2 NTA 2: Toxics in Roofing Materials. By 2013, Ecology will establish a task force that will oversee a study evaluating toxic materials (including toxic metals and, possibly, phthalates) in roofing materials and recommend strategies for promoting less-toxic alternatives or ways to use materials that minimize releases of toxic materials to receiving waters. To support the task force's work, Ecology will solicit information from manufacturers on the presence of toxic chemicals in roofing materials. Using any data from manufacturers or previously published studies, Ecology will create and implement a sampling strategy to assess the release of contaminants from different roofing materials. The task force will use this information to develop its recommendations.

Performance measure: Ecology will have a draft report of study findings by June 2013. The Task Force will have recommendations on strategies to promote safer roofing alternatives by December 2013.

C1.2 NTA 3: Green Chemistry Road Map. In 2012, Ecology and business, government, and academic stakeholders will finalize and begin implementing a green chemistry road map for Washington, including efforts to establish a Washington State green chemistry center. By 2013, Ecology will host a green chemistry conference in the region.

Performance measure: Green chemistry road map developed or not; green chemistry center established or not; green chemistry conference held or not.

C1.3 Adopt and implement plans and control strategies to reduce pollutant releases into Puget Sound from air emissions.

One of the ways that toxic chemicals enter Puget Sound is through air emissions. Sources include vehicle emissions, air emissions from business and industry, and combustion emissions from wood

stoves and fire places, among others. There are numerous woodstoves contributing to emissions; for example, in Pierce County, there are more than 25,000 uncertified stoves in the air quality non-attainment area alone. Statewide, Ecology has completed close to 9,000 retrofits on school buses and publicly owned fleets to reduce diesel emissions, resulting in large gains for public health; however, private fleets and vehicles are still large contributors to regional air quality issues. Private heavy duty trucks, locomotives, ships, and construction equipment all contribute large quantities of soot, PAHs, oils, and other toxics to the environment, and much of that ends up washing downstream into Puget Sound. This sub-strategy focuses on adopting air quality plans and requirements to reduce toxic air emissions, such as through SIPs to meet stricter National Ambient Air Quality Standards (NAAQS), and implementing the plans to achieve the reductions needed to meet the air quality goals. Over the longer term, there is also a need to improve air quality laws, regulations, and guidance to protect public health and the environment from air toxics.

Ongoing Programs

Air quality requirements will be tightening over the next several years, as EPA adopts new air quality standards for fine particulates and ozone, and as the boundaries of non-attainment areas in Puget Sound and elsewhere are subsequently redrawn. EPA adopted revised air quality standards for nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) in 2010 and is currently reviewing the air quality standards for fine particulates (PM 2.5). The ozone standard will likely be revised next in 2013. After adopting standards, EPA designates non-attainment areas, which are geographic areas that do not meet the standards, and then states need to prepare revised SIPs that outline emissions reductions and control strategies needed to meet the standards.

With the changes in air quality standards over the next several years, the number of nonattainment areas in Washington is expected to increase from one to four or more. The Tacoma/Pierce County State SIP for fine particulates is due in 2012, and the necessary regulations will be adopted in 2013. New non-attainment areas for fine particulates are expected to be designated in Washington in 2012, and this will lead to modeling of particulate emissions and the identification of control strategies by 2014. Additional monitoring for NO₂ and SO₂ will begin in 2012, driven by the revised standards. Ecology is also continuing its efforts to reduce diesel emissions. Through the state budget process, Ecology has secured \$7 million to assist local governments to outfit their diesel equipment with technology that would allow them to shut down their main engines while continuing to keep lights and radios functional. Ecology is also working with fire districts and emergency departments to reduce diesel idling emissions from fire trucks, emergency vehicles, and aid units.

An important aspect of air quality management in the region is inter-jurisdictional coordination, as sources of air pollutant emissions come from both within and outside the Puget Sound basin. For example, the NW AIRQUEST Consortium (Northwest International Air Quality Environmental Science and Technology Consortium), which encompasses Washington, Oregon, Idaho, Montana, Alaska, British Columbia, and Alberta, seeks to develop, maintain, and enhance a sound scientific basis for air quality management decision-making in the Pacific Western Region of North America. The SIPs that Ecology develops for specific non-attainment areas within Puget Sound consider the effects of transboundary air pollution and information from regional data centers such as NW AIRQUEST.

Key Ongoing Program Activities

- Ecology will complete development of a SIP for the Tacoma/Pierce County air quality non-attainment area for PM 2.5 by 2012, and will adopt the necessary regulations by 2013.
- Ecology will complete a statewide anti-idling regulation by July 1, 2013 to reduce petroleum emissions to the air. The regulations would be designed to reduce diesel soot, PAHs, and greenhouse gases from petroleum-powered engines and equipment.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

C1.4 Provide education and technical assistance to prevent and reduce releases of pollution.

This sub-strategy involves developing toxic chemical control and nutrient reduction strategies to encourage homeowners, businesses, and others to adopt behaviors that reduce their contribution to pollution. Numerous government and non-governmental organizations around Puget Sound have education and technical assistance programs; these include local stormwater, wastewater, and solid waste utilities; educational organizations such as Washington Sea Grant, Washington State University extension, and other colleges, universities, and schools; and non-profit and community-based organizations. Examples of programs that are particularly relevant to toxics reduction include:

- **Local source control program** is a partnership among Ecology and 25 local government jurisdictions that focus business technical assistance to prevent stormwater pollution and improve hazardous waste management practices. Local source control specialists help small businesses stop pollution that could harm Puget Sound.
- **EnviroStars** is a program that originated in 1995 in which local governments in six Puget Sound counties provide assistance and incentives for small businesses to reduce hazardous materials and waste, in order to protect public health, municipal systems, and the environment.
- **People for Puget Sound** works through education and action to protect and restore the land and waters of the Puget Sound basin. The organization has developed a series of fact sheets and communication resources on toxics threatening Puget Sound.
- **PSP Stewardship Program** is the Partnership's education and outreach effort to help people understand the threats to the Puget Sound ecosystem and what actions they can take to reduce toxic contaminants, nutrients, and other pollution into the Sound.
- **STORM** (Stormwater Outreach for Regional Municipalities) is a coalition of more than 60 municipal stormwater permittees in the Puget Sound region. These counties and cities work collaboratively to deliver relevant, vetted, coordinated stormwater messages and social marketing to the region's 4.5 million residents. STORM is a principal partner in the Puget Sound Starts Here campaign.
- **Puget Sound Starts Here** is a partnership of local governments, the Puget Sound Partnership, Department of Ecology, and local organizations that are part of the Partnership's ECO-Network. PSSH leverages the combined investments of all these organizations, and provides consistent public awareness and education messages across the twelve county Puget Sound region. Using state of the art communications techniques, it provides a regional communications umbrella to support and enhance the effectiveness of local stormwater program delivery.

- **Take Back Your Meds** is a group of organizations that support a statewide program for safe return and disposal of unused medicines to reduce access to addictive drugs, prevent poisonings, and reduce environmental contamination; it has a series of locations such as pharmacies where medicines can be dropped off.
- **Washington Toxics Coalition** advocates for policy changes to reduce toxic pollution, promotes safer alternatives to toxics, and educates people to create a healthy environment. Informational resources include strategies for reducing toxics at people's homes and gardens, in food, and in products children use.

These and other programs have had success in reducing the use and releases of toxic chemicals to our environment; however, funding constraints have limited the extent of implementation and, therefore, the results that have been achieved. Several existing EPA grants for Puget Sound-specific funding can be used for education and technical assistance; these include grants for work on toxics and nutrients, watersheds, and public engagement and stewardship, with Ecology and the Partnership serving as lead organizations.

Ongoing Programs

Ecology's Reducing Toxic Threats Initiative has several performance objectives and priority activities that relate to education and technical assistance for the 2011-13 biennium. Education-related objectives include developing a "Chemicals in Washington" report, responding to information requests from the "Toxic Free Tips" phone line and email, increasing distribution of Ecology's "Shoptalk" newsletter, increasing hits to Ecology's Hazardous Waste and Toxics Reduction Program website, and developing a marketing strategy for sharing pollution prevention success stories. Statewide performance objectives and activities related to technical assistance include:

- Document 150,000 pounds in lead, mercury, and cadmium reductions from businesses reporting via the Toxics Release Inventory (TRI).
- Reduce annual pounds of hazardous waste generated overall by 4 percent annually, with a long-term goal of 80 percent statewide reduction from 1990 levels by 2020.
- Through the Local Source Control Partnership, fund local government agencies to conduct 600 small business technical assistance visits per quarter to explain hazardous waste requirements to small businesses and prevent sources of polluted runoff to Puget Sound and the Spokane River. (Ecology currently has funding from EPA to support local source control inspections in the Puget Sound region.) Ecology prepares a biennial progress report on the Local Source Control Program describing program activities and results.
- Ecology staff will conduct 520 compliance-related technical assistance visits during 2011-13 to help businesses determine how to manage their hazardous wastes and reduce toxics use.
- Develop policy guidance on safe hazardous waste management and toxics use reduction for hospitals, used paint recycling, and auto shred residue.
- Create web-based dangerous waste workshop module for business technical assistance.
- Receive and review 100 percent (approximately 450) of pollution prevention plans received annually from businesses and facilities.
- Visit or assist 100 percent of pollution prevention planner facilities using or producing waste containing lead, mercury, or cadmium (about 25 toxic metal visits per quarter).
- Conduct 2-4 detailed technical assistance projects annually and 20 energy assessments.

In addition to these toxics and hazardous-waste focused programs, state, tribal, and local agencies and non-governmental organizations across Puget Sound also have education and assistance programs that focus specifically on preventing and reducing water pollution problems, including the following two ongoing program activities. Additional programs are discussed in other strategies in Section C.

Key Ongoing Program Activities

- EPA and Ecology will continue to support and expand the Local Source Control Partnership in Puget Sound in which local jurisdictions provide education and technical assistance to small businesses to prevent pollution and reduce sources of polluted runoff.
- Ecology will continue to support site visits and other technical assistance for pollution prevention planner facilities in the state that use or produce waste containing lead, mercury, or cadmium to help them to reduce their hazardous wastes.

Near-Term Actions

C1.4 NTA 1: Landscaper Accreditation. The landscape industry, in cooperation with other stakeholders, will establish a sustainable landscaper accreditation program to promote environmentally friendly landscape development and maintenance practices. Ecology will support this effort by providing start-up funding. The industry-led program will be designed to improve habitat and water quality by reducing the use of pesticides containing toxic chemicals, reducing the use of fertilizers, reducing use of water for irrigation, reducing runoff from landscaped properties, increasing natural stormwater filtration, reducing emissions from landscape equipment, and encouraging the use of native or other plants that provide riparian shade, support native pollinators, and require less pesticide, fertilizer, and water.

Performance measure: By December 2013, the organization identified to administer the accreditation program shall industry representatives will publish a report describing the program and/or next steps in establishing such a program.

C1.4 NTA 2: Environmentally Preferable Purchasing. By 2013, Ecology will work with the new Washington Department of Enterprise Services to develop environmental opportunity assessments for 6–10 contracts; these assessments will identify environmentally preferable purchases that could help reduce toxic pollution while seeking best value for the state. Best value includes looking at price, performance, availability and environmental considerations when developing and awarding contracts.

Performance measure: Number of completed “environmental opportunity assessments” for Department of Enterprise Services contracts, number of environmentally preferable purchases completed based on the assessments, pounds of hazardous wastes reduced per year.

C1.4 NTA 3: Conduct Local Source Control Business Assistance Visits. By July 2013, local governments, under contract with Ecology, will conduct at least 5,000 local source control visits to help small businesses reduce stormwater pollution and improve hazardous waste management.

Performance measure: Number of local source control visits completed per year.

C1.5 Control wastewater and other sources of pollution such as oil and toxics from boats and vessels.

Establishment of a No Discharge Zone (NDZ) along with sufficient and convenient pump out capacity and an effective outreach and education program will reduce pollution from vessels. The availability of sewage pump-out stations, the importance of the water body for human health and recreation, and the desire for more stringent protection of a particular aquatic ecosystem are important considerations in the designation of NDZs for vessel sewage. Discharge of untreated or partially treated human wastes from vessels sends toxic chemicals as well as pathogens, such as fecal coliform and viruses, into the water and increases human health risks. Excessive amounts of nutrients from vessel sewage exacerbate the known nutrient and low dissolved oxygen problems in Puget Sound.

In addition to wastewater management, boats and vessels have the potential, because they are operated in the marine environment, to be a source of other pollutants to Puget Sound. These include oils, greases, paints, soaps and trash. Programs like the Clean Marina program, a collaboration between Puget Soundkeeper Alliance, Northwest Marine Trade Association, EnviroStars Cooperative, Washington Sea Grant, Ecology, DNR, and the State Parks and Recreation Commission work with marinas to help boat owners reduce and eliminate all sources of pollution to Puget Sound.

Ongoing Programs

Using National Estuary Program grant funds, Ecology and DOH coordinate with State Parks' Clean Vessel Program to inventory and improve existing pump-out facilities, gauge stakeholder support, and determine the geographic scope of a NDZ. This work will culminate in a draft petition to EPA for the designation of a NDZ by fall 2013, with a final petition by the end of 2016. Expected performance measures include:

- Improved pump-out capacity
- Successful designation of NDZ in Puget Sound
- Reduction in vessel sewage discharged into Puget Sound

Near-Term Actions



C1.5 NTA 1: No Discharge Zone Evaluation and Petition. By December 2013 Ecology and DOH, in coordination with the Department of Natural Resources, will conduct an evaluation and draft a petition to EPA to establish a NDZ for commercial and recreational vessels to eliminate ~~bacteria, nutrients, and pathogens from being discharged~~ discharges of sewage to all or parts of Puget Sound. It is not the intent of this NTA to prohibit discharges of treated sewage from moving vessels that have advanced wastewater treatment systems that meet secondary treatment standards specified in 40 CFR Section 133.102 and provide disinfection. The evaluation will include researching petition requirements; gathering background information and pump-out station data for the petition; identifying, reaching out to, and getting input of stakeholders;

Comment [KG6]: Suggested NTA revisions and rationale below from Lincoln Loehr – citizen

Rationale:

"Many large cruise ships that transit through Puget Sound have advanced wastewater treatment systems that perform much better than the federal and state secondary treatment requirements. The effluent quality from these discharges has been well characterized by EPA (2008)¹ as well as in annual reports by Alaska's Department of Environmental Conservation¹. Furthermore, discharges from large cruise ships when underway achieve very rapid dilution, and have dilution factors that are typically three orders of magnitude greater than dilution factors achieved for municipal outfalls. The dilution effects have been well documented by EPA¹ and by the Alaska Cruise Ship Wastewater Discharge Science Advisory Panel (2002)¹. The Science Advisory Panel's work was also described in a 2006 article in Marine Pollution Bulletin¹.

identifying and prioritizing which areas of the Puget Sound are feasible for petition; and evaluating how to implement the designation.

Performance measure: Completion of draft elements of an evaluation by July 2012 (Phase I); Completion of stakeholder outreach, surveys, geographical locations by July 2013 (Phase II); Completion of draft petition to EPA by September 2013.

C1.5 NTA 2: Pump-Out Station Improvements. Ecology and DOH, with National Estuary Program grant funding, will coordinate with Washington State Parks' Clean Vessel Program to assist in construction, repair and monitoring of pump-out stations to meet requirements of the NDZ petition.

Performance measures: Number of pump-out stations added or improved. Amount of sewage pumped out. Pump out capacity is able to support a NDZ designation.

C1.5 WS 9: West Sound Pump Out Stations. By January 2013, Kitsap Public Health will identify potential pump out stations and develop needs assessment to address marine vessel sewage.

Performance measure: To be determined.

C1.6 Increase compliance with and enforcement of environmental laws, regulations, and permits.

Local, state, and federal programs periodically inspect regulated facilities in Puget Sound to ensure compliance with applicable laws and regulations. These include air emissions control requirements under the Clean Air Act and the relevant SIP (as discussed in C1.3 above), industrial wastewater pretreatment requirements under the Clean Water Act (discussed in C6.1), and hazardous materials and waste management requirements such as the federal Resource Conservation and Recovery Act (RCRA) and the state Dangerous Waste and Pollution Prevention Plan regulations. This sub-strategy helps assure compliance with environmental laws governing hazardous materials and waste through targeted enforcement of those laws. Many of the agencies that conduct compliance inspections, as well as some not-for-profit organizations, also have technical assistance programs that provide education, training, and assistance to businesses seeking to prevent pollution and emissions and improve facility operations (technical assistance efforts are discussed in strategy C1.4).

Ongoing Programs

Ecology has Puget Sound-specific funding from EPA for work in this area, under the Toxics and Nutrients grant award. Additional funding could allow Ecology staff to conduct more compliance inspections and follow-up activities to prevent and reduce toxic releases. Ecology has proposed the following performance measures for its hazardous waste compliance program for the next two years (these are statewide targets):

- FY2012: Conduct 345 compliance inspections, including 5 treatment, storage, and disposal (TSD) facilities and 82 large quantity hazardous waste generators. Attain a 39.5 percent or less chance of finding a significant environmental threat during a compliance inspection.

- FY2013: Conduct 410 compliance inspections, including 5 TSD facilities and 82 large quantity hazardous waste generators. Attain a 37 percent or less chance of finding a significant environmental threat during a compliance inspection.
- Respond to and close out 100 percent of hazardous-waste related complaints at Washington facilities (approximately 120-180 complaints per year).

Near-Term Actions

C1.6 NTA 1: Hazardous Waste, Wastewater, and Air Quality Compliance and Enforcement. Increase Ecology's hazardous waste, and wastewater compliance inspection and enforcement programs in the Puget Sound.

Performance measure: Number of compliance inspections completed per year, pounds of hazardous wastes and air pollutants reduced per year, volume of wastewater discharges reduced per year.

C1.6 NTA 2: Compliance for Use of Toxics in Products. Ecology will conduct compliance activities for state laws banning the use of toxic materials (e.g., PBDEs) in products, including taking appropriate enforcement actions against noncompliant products.

Performance measure: By June 30, 2013, Ecology will publish a report on product sampling and follow up actions taken.

Emerging Issues and Future Opportunities

Specific longer-term activities to control sources of toxics that were identified during the Action Agenda update process include the following:

- If justified by findings from Puget Sound basin studies of pesticides, WSDA will work with Ecology and other partners to tailor pesticide management in the Puget Sound basin. A WSDA decision to adapt the management of pesticides in the Puget Sound basin will consider information about pesticide use (e.g., uses of copper containing pesticides, homeowner use of pesticides), refined estimates of pesticide contributions to toxic chemical loading, and surface water monitoring of pesticides.
- Ecology will continue to work with EPA and other partners to evaluate, recommend, and institute additional requirements to address threats posed by air toxics.
- Options should be evaluated for expanding the phase-out of copper bottom paint to include ships over 65 feet in length and/or commercial vessels of various sizes. A work group could be formed to develop recommendations related to an expanded phase-out.

Other ways that this strategy to reduce the sources of toxic chemicals entering Puget Sound could be advanced include the following items:

- Conducting scientific investigations of topics such as chemical causes of endocrine disruption (apparent as reproductive impairment) in Puget Sound fish, studies of the amount, fate, and transport of petroleum releases from drips and leaks, and gathering source data for PBT chemicals that were not included in the Puget Sound Toxics Loading Study.

- Exploring the possibility of additional authorities and/or voluntary agreements to have the private sector accept responsibility for product stewardship (e.g., targeting products that contain chemicals of concern). (Ecology already plans to develop a product stewardship program for lamps containing mercury.)
- Initiating a broad-based effort to investigate additional ways to reduce the release of toxic contaminants from vehicles and roadways (i.e., are there alternative means of ensuring the mobility of people and goods that would decrease the loads of toxic chemicals released to the environment?).
- Developing a chemical action plan or similar assessment and plan for reducing the use and releases of halogenated flame retardants. (This would be completed after a CAP on PFCs, depending on funding availability.)
- Addressing the use and application of sewage sludge.

Reduce Pressures on the Puget Sound Ecosystem from Runoff from the Built Environment

The Challenge

Urban stormwater runoff poses a high risk to the health of Puget Sound by causing two major problems.

First, the runoff transports a mixture of pollutants such as petroleum products, heavy metals, bacteria, nutrients, and sediments from construction sites, roads, highways, parking lots, lawns, and other developed lands with the following results:

- Urban stormwater is the leading contributor to water quality pollution in urban creeks, streams and rivers in the state.
- Urban stormwater is a significant contributor of toxics to marine sediment, including contaminated sites undergoing cleanup.
- Three species of salmon (Chinook, Summer Chum and Steelhead) and bull trout are listed as threatened species under the federal Endangered Species Act (ESA). Loss of habitat due to stormwater and development is one of the causes.
- Shellfish harvest at many beaches is restricted or prohibited due to pollution. Stormwater runoff is often one of the causes.
- Stormwater causes the death of high percentages of healthy coho salmon in Seattle creeks within hours of the fish entering the creeks before the fish are able to spawn.
- English sole are more likely to develop cancerous lesions on their livers in more urban areas. Stormwater pollutants likely play a role.
- Although more research is needed, there are some indications that urban stormwater runoff may contribute to the decline of eelgrass populations.

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Second, during the wet winter months, high stormwater flows, especially long-lasting high flows, can:

- Cause flooding;
- Damage property; and
- Harm and render unusable fish and wildlife habitat by eroding stream banks, scouring stream beds and widening stream channels, depositing excessive sediment, and altering natural streams and wetlands.

In addition, more impervious surface area means fewer opportunities for water to soak into the ground. As a result, groundwater drinking water supplies may not replenish and streams and wetlands may

not be recharged. This can lead to water shortages for people and inadequate stream flows and wetland water levels for fish and other wildlife.

SALMON RECOVERY

Managing and Reducing Stormwater – A Salmon Recovery Plan Priority: Improvement in water quality is identified in the salmon recovery plan with a call to resolve uncertainty about whether the regional water quality actions address the needs of salmon. Volume I identifies general concerns related to stormwater runoff. Watershed chapters for WRIA 8 and WRIA 9 have strategies/actions related to stormwater and water quality. One item that is of particular interest in WRIA 8 and 9 but also in other watersheds is the issue of pre-spawn mortality of different species of salmon.

How these priorities are integrated: The Action Agenda contains more detailed strategies and actions to address stormwater runoff in the built environment than the Salmon Recovery Plan. While the Action Agenda addresses the general concerns in the Recovery Plan, the resolution about the effectiveness of actions still needs to be addressed.

A significant amount of the work completed for the 2011 Action Agenda Update was informed by the draft *Stormwater Vision and Financing Strategy for Puget Sound*, the *Task 1: Urban Stormwater Runoff Preliminary Needs Assessment Technical Memorandum* (October 2010), and work by a subcommittee of the Ecosystem Coordination Board focused on stormwater funding. An interagency team of stormwater professionals used these foundation documents to suggest the draft sub-strategies and near-term actions contained in this section. The purpose of the *Stormwater Vision* is to suggest comprehensive actions and financing strategies that will reduce polluted surface runoff from urban and rural landscapes to Puget Sound.

The *Stormwater Needs Assessment* highlights (1) the needs for regional local governments to fully implement the municipal NPDES stormwater permit programs and (2) estimated costs to carry out stormwater retrofits (described below in the sub-strategy on existing development). Puget Sound municipal permit holders invested between \$160–170 million in 2009 to implement the municipal permits. This figure represents a significant portion of the total they spent on stormwater management. While state and federal assistance via grants and loans are substantial (in FY 2011 the Department of Ecology (Ecology) disbursed \$23.5 million for permit assistance and an additional \$23.4 million for low impact development and retrofit projects), the state and federal portion of total costs pales in comparison to what local governments spent.

The Ecosystem Coordination Board (ECB) Stormwater Funding Subcommittee's report details recommendations that include the need for greater overall investment in stormwater management in the region and the need for more financial assistance to local governments, who currently shoulder the majority of costs. Current investments in addressing problems caused by existing development through structural retrofits are not nearly sufficient – the cost to retrofit existing development for treatment alone is estimated to cost, at a minimum, \$3-16 billion (*Stormwater Needs Assessment*). Local stormwater utilities in many cases will need to be increased, and local governments need support to successfully raise local stormwater rates. Concurrently, the level of investment by the state and federal

government must be increased significantly to help share the burden of costs so that we can adequately address the scope of stormwater problems and meet related 2020 ecosystem recovery targets.

In addition to the strategy and sub-strategies presented here, the strategies to reduce land development pressures (A1, A2, A3, A4, A5, and B1 and 2) plus the toxics control strategies in C1 are essential to addressing stormwater.

Climate Change

Declining snow pack and loss of natural water storage, changes in precipitation timing including seasonal streamflow and more severe winter flooding, and more frequent and extreme storm events will likely strain our stormwater systems and increase the amount of polluted runoff flowing to Puget Sound. Potential impacts include:

- Winter flooding could strain the capacity of urban drainage infrastructure and result in more frequent combined sewer overflows.
- The intrusion of seawater due to increased melting of polar ice caps coupled with higher storm surges could damage equipment and strain the capacity of wastewater and stormwater systems.
- Backflow of water through stormwater pipes could cause localized flooding in low-lying areas. Drainage of low-lying areas will become more difficult and stormwater management may require installation of tide gates, control works, or pump systems.

To reduce the risk of damage to buildings, transportation systems, and other infrastructure is a high priority over-arching response strategy identified in *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy (April 2012)*, which directly relates to stormwater. This means identifying vulnerable areas and taking proactive steps to reduce risks to infrastructure and avoiding risks when siting new infrastructure, supporting local efforts to prepare for coastal flooding and storm surges and considering climate change impacts when new developments and infrastructure are sited.

Specific strategies related to stormwater include:

- **Managing water resources in a changing climate by implementing integrated water resources management approaches in highly vulnerable basins.** This includes developing guidance for whether and how to incorporate project climate information and adaptation actions into planning, policies and investment decisions. This will ensure that investments made now are not increasing future vulnerability and causing unintended consequences.
- **Building the capacity** of state, tribal and local governments, watershed/regional groups, water managers, and communities to identify and assess risks and vulnerabilities to climate change impacts on water. This includes making sure utilities have tools and modeling to integrate climate impact information into stormwater planning and design.
- **Enhance the preparedness of transportation, energy and emergency service providers to respond to more frequent and intense weather-related emergencies.** This includes early warning and adjustment of routine maintenance and inspection to prepare for more frequent and intense storms and floods.

The stormwater strategies and actions in the 2012 Puget Sound Partnership Action Agenda will need to be adapted over time to address climate change effects. This includes infrastructure siting and design, as well as prioritization criteria.

Local Priorities

Local Integrating Organization	Priorities
San Juan Islands	<p><i>Tier 1 Strategies</i></p> <ul style="list-style-type: none"> • Create effective compliance mechanisms for stormwater • Implement best management practices to reduce pollution of source wastes by residential runoff and non-point sources. <p><i>Tier 2 Strategies</i></p> <ul style="list-style-type: none"> • Restore native vegetation, trees, and ground cover. • Provide information to landowners about pollutants around the home and farm and provide information on proper storage and care. • Encourage Low Impact Development for new development and retrofits. • Provide information and work with the public regarding Low Impact Development (LID) so they can implement LID on their own properties, including farms. • Ensure coordination between planning and health departments on issuance of septic permits. • Implement San Juan Marine Stewardship Area Monitoring Plan, including the Stormwater Monitoring Plan.
Strait of Juan de Fuca	<p><i>Top Priorities</i></p> <ul style="list-style-type: none"> • Stormwater Management Program Updates and Implementation (Clallam, Jefferson, Port Angeles, Sequim, and Port Townsend).
South Central	<p><i>Key theme</i></p> <p>To successfully advocate for state and federal funding for stormwater investments in Puget Sound, there needs to be a more refined assessment of total need and priorities across the region for retrofits, operation and maintenance, and source control.</p> <p><i>Top Priorities</i></p> <ul style="list-style-type: none"> • Fund and implement stormwater retrofits, improvements to operations/maintenance of existing stormwater infrastructure, and additional source control measures. • Incorporate low impact development (LID) requirements into stormwater codes and develop and implement LID incentives. • Keep toxics and excess nutrients out of stormwater runoff and wastewater.
South Sound	<p><i>Strategic Initiative: Urban Stormwater/ Runoff</i></p> <ul style="list-style-type: none"> • Achieve a balance of local, state and federal funding for full implementation of NPDES) municipal stormwater permits, stormwater retrofitting and stormwater management on a watershed basis. • Work with Eatonville to manage their stormwater and domestic water consistent with salmon recovery objectives.

Local Integrating Organization	Priorities
Hood Canal	<p><i>High Priority</i></p> <ul style="list-style-type: none"> HCCC is pursuing a stormwater retrofit program to identify and prioritize stormwater retrofit opportunities throughout the Hood Canal watershed. <p><i>Sample General Strategies</i></p> <ul style="list-style-type: none"> Revise development code to incorporate current stormwater management practices, specifically by adopting and incorporating the most current Ecology stormwater manual. Adoption of low impact development (LID) practices to be used as a first choice to the maximum extent practicable in new development, redevelopment, and retrofitting Retention of natural land cover as the most effective way to prevent stormwater runoff.
West Sound	<p><i>High Priority</i></p> <ul style="list-style-type: none"> Adopt and implement the most current stormwater and LID regulations and design guidance Implement new stormwater program regulations that address vesting and create incentives for developers (upland areas in particular) to conserve ecosystem function. Implement stormwater and LID Retrofit Plan projects in priority areas and continue stormwater and LID retrofit planning in other priority areas.
Whatcom	<p><i>Strategies under development</i></p> <ul style="list-style-type: none"> Implement NPDES municipal and industrial permits Continue implementing comprehensive stormwater management plans Coordinate and support implementation of education and outreach plans associated with urban landscapes
Skagit Watershed, Stillaguamish-Snohomish Watersheds, Island Watershed	All three areas have discussed the important of implementing NPDES permits, stormwater retrofits in dense urban areas, and supporting low impact development efforts.

Relationship to Recovery Targets

The 2020 ecosystem recovery target for runoff from the built environment is native communities of insects in small streams of wading depth. This target was chosen because runoff from the built environment, also known as urban runoff, directly affects the structure, habitat, and fish and wildlife in small, wading-depth lowland streams of Puget Sound. Insects found in these small streams serve as strong indicators for the relative biological health of Puget Sound freshwater stream systems. If communities of native insects in these streams are plentiful and diverse, other biological components, including salmonids, should be healthy as well. A functioning, resilient Puget Sound requires lowland streams that support the salmonids and invertebrates native to this region, as indicated by benthic index of biotic integrity (B-IBI) scores. The target states that, “by 2020, 100 percent of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42–46 or better retain these ‘excellent’ scores and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from ‘fair’ to ‘good.’”

The Puget Sound Stream Benthos, a website developed by officials from the City of Seattle, King County, Pierce County, Snohomish County, and others provides a database that allows sharing of benthic macroinvertebrate data among organizations and provides tools for calculating metrics and indices. The database fulfills the goal of storing macroinvertebrate data in a manner that allows for reliable comparisons across sites and programs over time.

The stormwater runoff strategies in this section are designed to help achieve the target. In addition, these strategies help achieve targets for land development, land use and land cover, freshwater quality, shellfish beds, toxics in fish, and marine sediment quality.

C2. Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales

C2.1 Manage urban runoff at the basin and watershed scale.

Urban runoff cannot be fully managed at the site and parcel levels alone – it is also necessary to manage runoff at the broader basin and watershed scales. Numerous regional and national studies show that as native vegetation and soils are replaced by rooftops, roads, and other hard surfaces, numerous environmental indicators decline. Local land use decisions (i.e., location, type, and intensity of development) directly affect urban runoff quantity and quality within watersheds. This sub-strategy addresses the need to protect native vegetation, soils, and high quality habitat; site new development appropriately; and better connect land use and stormwater management.

In addition to the sub-strategies listed in this section, the region must have a robust, effective program to regularly monitor and assess the effects of stormwater runoff on receiving waters and the effectiveness of best management practices (BMPs), programs and permit requirements in mitigating these effects. The ongoing monitoring and assessment work of the Stormwater Monitoring Work Group, Washington Stormwater Center and partners are described in strategy D4.

- **Protect native vegetation and high quality streams.** Protecting native vegetation, soils and high quality habitat, particularly in remaining stream drainages with “excellent” B-IBI scores through actions outlined in sections A and B, requires mapping locations of these streams, and carrying out strategies to protect the streams. This involves using tools such as the Puget Sound Watershed Characterization Project (Watershed Characterization), growth management and shoreline planning, critical areas and other land development regulations, proposed LID requirements in municipal National Pollutant Discharge Elimination System (NPDES) permits, stormwater management manuals, land conservation programs, landowner incentive programs, and other measures. More information on strategies and actions related to watershed characterization is described in strategy A1.1.
- **Site new development appropriately.** New development needs to be sited appropriately, using the watershed characterization study, Growth Management Act (GMA), Shoreline Management Act (SMA), State Environmental Protection Act (SEPA), and other tools. The Watershed Characterization, other watershed plans, and, where needed, finer scale analyses can be used to

identify areas most appropriate to protect, develop and restore through structural retrofits, legacy pollutant removal, and other means. Where development is targeted, smart growth concepts can ensure that compact, mixed-use, mass-transit supported development increases. More information on these issues is in A2, A3 and A4.

- **Better connect land use and stormwater management.** Land use planning and stormwater management need to be integrated. Development of watershed plans based on Watershed Characterization data that integrate land use planning and stormwater management could be accomplished by either (1) reactivating and funding Clean Water Act (CWA) Section 208 planning to include major land uses (urban, agricultural/rural, and forestry) and water resource elements such as stormwater, combined sewers, wastewater, water supply, reuse and non-point sources; or (2) supporting and funding the development of stormwater plans, watershed plans, or Water Resource Inventory Area (WRIA) plans that address the full spectrum of water resource elements and land use on a regional basis. The impacts of land use decisions on stormwater runoff and receiving waters should be evaluated. Regulations should be aligned with watershed plans, including municipal, industrial and construction NPDES permits, non-point source control programs, critical areas ordinances, SMA, SEPA, ESA, and the GMA if warranted.

Ongoing Programs

Watershed Characterization: The Puget Sound Watershed Characterization (Watershed Characterization), a collaborative effort between Ecology, PSP, and Washington Department of Fish and Wildlife (Fish and Wildlife) is designed to provide local governments with better information to improve land use planning and resource protection at the watershed scale. The Watershed Characterization is a regional-scale perspective that divides the Sound geographically into three areas: those most important to protect, those most beneficial to restore, and those most suitable for development. It is designed to describe a multi-scale framework for land-use planning. The results from the assessments should help guide the protection and restoration of watersheds and the habitats they support. The Watershed Characterization effort includes an outreach component to explain the role and proper application of these assessments.

Near-Term Actions



C2.1 NTA 1: Watershed-Based Stormwater Management. PSP in consultation with Ecology and with guidance from the Ecosystem Coordination Board, will evaluate the feasibility, costs, and effectiveness of expanding the existing, municipal stormwater jurisdiction-by-jurisdiction permit approach, using "general permits," to include additional watershed-based municipal stormwater management practices. PSP will complete the evaluation and provide to Ecology for consideration by February 2013. PSP, with guidance from the Ecosystem Coordination Board, will evaluate the effectiveness of transitioning the existing, municipal stormwater jurisdiction-by-jurisdiction permit approach, using "general permits," to watershed-based municipal stormwater management by February 2013. This action is based on the ECB policy paper on stormwater.

Performance measure: PSP to commission and complete an evaluation of the effectiveness of transitioning to watershed-based municipal stormwater management and provide to Ecology by February 2013, and give a presentation and discuss next steps with the ECB by March 2013. PSP to commission and complete an evaluation of the

Comment [KG7]: Changes from Stormwater SI subcommittee

"This amendment increases coordination with the managing agency charged with stormwater management, and will help ensure a product that is useful and applicable. It also changes language slightly to show the intention is to expand the permit, incorporating watershed approach into existing framework, rather than transition to something new."

~~effectiveness of transitioning to watershed-based municipal stormwater management by February 2013, and give a presentation and discuss next steps with the ECB by March 2013.~~

- C2.1 NTA 2:** **Protect Best Remaining Streams.** King County, in cooperation with agencies populating the Puget Sound Stream Benthos database, will identify and map remaining streams with B-IBI scores of at least 42-46 and develop an overall strategy and tailored actions to protect these areas by September 2013.

Performance measure: Map of targeted streams by March 2013; strategies and actions to protect targeted stream drainages by September 2013.

- C2.1 NTA 3:** **Stormwater System Mapping.** King County in cooperation with Ecology, local governments, WSDOT, and Department of Natural Resources, will help improve understanding and management of the region's stormwater infrastructure by developing protocols, methodology and definitions for stormwater system mapping, ~~and developing geo-referenced databases that can be compiled into a regional geo-referenced database of the Sound's regulated, municipal stormwater system.~~ Following completion of this work, seek funding to develop a geo-referenced database of the Sound's regulated, municipal stormwater system.

Performance measure: Protocols, methodology and definitions to guide mapping and documentation efforts by May 2013; seek funding to develop geo-referenced database by December 2013; ~~completed geo-referenced database by December 2013.~~

C2.2 Prevent problems from new development at the site and subdivision scale.

New development at the site and sub-division scale can be a significant source of stormwater-related problems. Effective management of sediment on construction sites using Best Management Practices (BMPs) and other tools from the Stormwater Management Manual for Western Washington (or a local, equivalent manual), inspections, and enforcement (when needed) can prevent sediment and other contaminants from reaching surface waters, where they can cause harm. Appropriate design, siting, installation, and maintenance of permanent BMPs is critical to ensure they perform as designed. This sub-strategy includes federal Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) permits for municipalities, state highways, industries, construction sites, and boatyards; continued transition to low impact development; and ensuring new development outside NPDES permitted areas uses standards and practices equivalent to those used within permitted areas.

- **Stormwater NPDES Permits:** Federal CWA NPDES permits are in place for municipalities, state highways, industries, construction sites, and boatyards. All NPDES stormwater permits for western Washington must be issued, implemented, overseen, complied with, and improved over time according to federally established timelines. Municipal stormwater permits need to contain requirements for low impact development (LID), monitoring, and structural retrofits. The need to bring in additional local governments under municipal permits to cover more land area of the basin should be evaluated. Funding is needed for municipal permittees to carry out permit requirements. Permits for federal and tribal lands/facilities also need to be ~~are~~ consistent

with state-issued NPDES stormwater standards and permits. The state-approved stormwater manuals should be updated as needed, including planning for climate change.

- **Low Impact Development.** The regional transition to low impact development should continue. Technical guidance and educational materials should continue to be developed and revised to help transition the region to the use of LID and other green infrastructure approaches. State-approved runoff manuals should continue to refine how these techniques are modeled, sited, designed and maintained. Guidance to local governments on integrating LID into codes and standards should also continue. This work includes providing information on projects, costs, performance, longevity, maintenance needs, and how best to integrate LID facilities into existing drainage systems. Refining and providing incentives for LID and other green infrastructure approaches is part of this sub-strategy. Local governments need funding review of development proposals, inspections, enforcement, and maintenance of facilities.
- **Consistent, Basin-Wide Management of New Development.** To protect and restore resources and beneficial uses everywhere in the basin, including shellfish harvest areas and salmon habitat, ensure that new development outside NPDES-permitted areas includes stormwater management standards and thresholds that are technically equivalent to the Stormwater Management Manual for Western Washington. Ensure that local governments located outside NPDES-permitted areas carry out stormwater management programs that are consistent with the NPDES municipal stormwater permit for western Washington.

Ongoing Programs

NPDES permits: Ecology administers NPDES stormwater permits for municipalities, industries, construction sites, boatyards, and the Washington State Department of Transportation (WSDOT). Municipalities with populations over 100,000 are covered by NPDES Phase I permits. In Puget Sound, this includes King, Pierce and Snohomish counties and the cities of Seattle and Tacoma. Municipalities with populations under 100,000 located in urbanized areas, as defined by U.S. EPA rules, are covered under Phase II permits. In 2012, there were 76 local governments in Puget Sound covered by the western Washington Phase II permit. An NPDES municipal stormwater permit also exists that covers WSDOT's transportation facilities within the Phase I and II permit areas. Ecology maintains the Stormwater Management Manual for western Washington, the region's stormwater technical manual, which contains minimum requirements, technical standards and best management practices for new and redevelopment projects. Ecology also issues and oversees NPDES permits for construction sites, industries, and boatyards.

In 2009, the state legislature directed Ecology to work with stakeholders to establish a stormwater technical resources center. The Washington Stormwater Center, jointly managed by Washington State University (WSU) Extension, the City of Puyallup, and the University of Washington (UW), Tacoma Urban Waters will provide technical assistance to municipal and industrial stormwater NPDES permit holders, education and training, research and monitoring of LID practices, and review and approval of new stormwater BMPs.

Low Impact Development: Providing the right tools to transition the region to the use of LID techniques is key. WSU Extension and PSP, with help from regional professionals, are revising the region's manual on LID, the "LID Technical Guidance Manual for Puget Sound." WSU Extension and UW offer LID professional training and certificate programs. Seattle and other local governments have developed guidance, educational materials, and checklists for ongoing maintenance of systems. PSP is developing "Integrating LID into Local Codes: A Guidebook for Local Governments" to help local staff integrate LID

into their codes and standards. Ecology plans to provide new standards and training on maintenance of systems. Many local governments, developers and builders, and consulting engineers provide leadership by designing and building innovative LID projects.

Key Ongoing Program Activities

- Ecology reissues updated municipal NPDES stormwater permits for western Washington and an updated *Stormwater Management Manual for Western Washington* by July 2012.
- WSU Extension and PSP reissue the updated *LID Technical Guidance Manual for Puget Sound* by July 2012.
- PSP issues the *Integrating LID into Local Codes* guidebook by July 2012.

Near-Term Actions



C2.2 NTA 1: NPDES Municipal Permits. Ecology will issue municipal permits for western Washington and provide financial assistance to permittees for implementation, particularly for code changes, stormwater system mapping, operations and maintenance, inspections and enforcement. This will require additional resources to Ecology for permit oversight, technical assistance, and enforcement. Ecology will provide incentives to NPDES permittees who, by interlocal agreement, lead or carry out regional or watershed scale NPDES implementation.

Performance measure: Reissued, improved municipal permits by July 2012; additional resources to Ecology by July 2013; financial assistance provided to permittees by December 2013; incentives provided to permittees for regional implementation by December 2013.

C2.2 NTA 2: Stormwater Treatment Standards. Ecology will evaluate under which circumstances (i.e., for which pollutants, from which land uses) discharges to Puget Sound should be required to provide treatment beyond sediment removal (i.e., TSS removal) to help meet 2020 recovery targets.

Performance measure: Evaluation with supporting documentation by March 2014.



C2.2 NTA 3: Stormwater Management Outside Permitted Areas. Ecology, in coordination with the state Department of Health, will identify two high priority shellfish growing areas degraded by urban stormwater discharges and work with local governments and other key parties to reduce these impacts to the areas.

Performance measure: Areas identified by September 2012; assistance provided to non-permitted local governments by December 2012; documentation of reduced impacts by March 2014 and at conclusion of projects.

C2.2 NTA 4: New Development Under Earlier Stormwater Programs. Ecology will initiate a process to assess projected implications and impacts of current state law concerning the level of stormwater control from new development approved under earlier stormwater programs.

Performance measure: RFP issued by August 2012; project lead awarded and project lead to develop new milestones to deliver a report on projected implications and impacts by at least December 2012.

- C2.2 SJI 3:** **SJ Improve Stormwater Permit Review.** San Juan County Community Development and Planning Department (CDPD) and the Town of Friday Harbor will improve the stormwater permit review process with pre-disturbance site review and follow-up site visits at 50 percent of properties permitted between 2012-2015.

Performance measure: Pre-disturbance site review and follow-up site visits at 50% of properties permitted between 2012-2015.

- C2.2 STRT 5:** **Straits Stormwater Management Programs.** Stormwater Management Program Updates and Implementation (Clallam, Jefferson, Port Angeles, Sequim, and Port Townsend).
- a. City of Port Townsend Stormwater Management Plan
 - b. City of Sequim Stormwater Management Plan
 - c. City of Port Angeles CSO reduction
 - d. City of Port Angeles NPDES Stormwater Management Program implementation
 - e. Jefferson County Public Education Plan implementation
 - f. Jefferson County low impact development and BMP staff training
 - g. Jefferson County low impact development and BMP training for development community
 - h. Clallam County stormwater technical assistance
 - i. Clallam County outreach and education
 - j. Clallam County stormwater monitoring and data analysis
 - k. Clallam County stormwater management staff training
 - l. Clallam County land use analysis
 - m. Clallam County Stormwater Management Plan
 - n. Speaker forum on reducing stormwater impacts from roads

Performance measure: Adoption of LID incentives and ordinances by all 5 Strait Action Area local jurisdictions; Alternative Option: Initiate or complete 25% of the new Priority Actions identified by the Strait ERN for the Strait Action Area.

C2.3 Fix problems caused by existing development.

Most development within the Puget Sound basin was built prior to the use of local and state stormwater manuals that require management of stormwater discharges. This development, unless already retrofitted, may be presumed to be discharging untreated or undertreated stormwater, and inadequate management of high flows. Stormwater discharges from existing development can be mitigated through a variety of means: Structural retrofits, regular and enhanced maintenance to remove legacy pollutant loads, and/or redevelopment policies. The "Urban Stormwater Runoff Preliminary Needs Assessment Technical Memorandum" (October 2010), in a survey of 20 permit holders, found that system cleaning was highly effective: 234,000 tons of total solids were removed in 2009. This is believed to be due to "past underfunded maintenance" of stormwater systems. The report further estimates that, conservatively, an estimated \$3–15.6 billion is needed to upgrade existing stormwater systems within

municipal permit areas for treatment. The report states that “prioritization is necessary” (given the huge investment required) and that “acceleration of the maintenance, inspection, and pollutant source investigation elements of the... permit program, in combination with addressing the highest priority retrofits, is recommended.” This sub-strategy includes: fixing problems from existing development through structural retrofits; ongoing regular maintenance and enhanced maintenance; and redevelopment policies and activities.

- **Structural Retrofit:** Over time, existing development needs to be upgraded, as needed, with flow control and treatment techniques that contribute towards meeting 2020 ecosystem recovery targets. Structural retrofits should focus on areas that would benefit most, and assess whether structural upgrades or other means (e.g., source control, maintenance) will achieve objectives. This work should include, assessing the level of effort needed (i.e., number of projects and acres retrofitted) to meet goals. Adequate, new funding will be needed to ensure significant progress is made.
- **Maintenance:** Stormwater pollution prevention plans must be carried out and all stormwater systems need to be regularly inspected and maintained to function to engineering design standards. Removing legacy loads from portions of the systems needs to be assessed and carried out, building on City of Tacoma’s study on removal of legacy loads. Technical and financial assistance should be provided to local governments.
- **Redevelopment:** Ensure that redevelopment policies in state-approved stormwater manuals and permits are fully implemented and bring about improvements to runoff from existing development. Revise policies as needed as one tool to upgrade stormwater controls on existing development.

Ongoing Programs

Retrofit: Local governments in Puget Sound run capital improvement programs and, as funding becomes available, undertake projects to improve their stormwater systems. While flood prevention and property protection are most often targeted, many programs and projects also address water quality, fish habitat, and discharges to shellfish harvest areas. Municipal phase I permit holders are required to run structural stormwater programs that include construction of new and improvements to existing facilities.

The municipal NPDES permits require that existing stormwater systems be upgraded when certain thresholds are reached during a redevelopment project. This is an opportune time, or “window of opportunity” to improve existing stormwater infrastructure; however, the current rate of redevelopment within the basin is fairly low.

Maintenance: Local governments, industries, and boatyards regularly maintain their permanent BMPs according to permit requirements and to ensure they continue to perform as designed. This regular, systematic, ongoing maintenance is critical to the functioning of systems, since unmaintained stormwater infrastructure can actually export pollutants.

Several local governments, such as the City of Tacoma, have undertaken enhanced maintenance activities to remove legacy (or long-residing) pollutants from their systems. This system “flushing” can be highly effective at removing large amounts of pollutants in a cost-effective manner.

Near-Term Actions



C2.3 NTA 1: Stormwater Retrofit Projects. ~~Ecology will lead a process to identify high priority retrofit projects that will contribute to the recovery of Puget Sound and complete conceptual design to a stage sufficient to seek project implementation funding. The work will build on retrofit prioritization work by WSDOT, King County and others, and will be replicable in other urban and suburban areas around the Sound. Ecology will lead a process to identify the top priority retrofit projects associated with the transportation infrastructure in the urbanized portions of King, Pierce, Kitsap and Snohomish counties and complete conceptual design to a stage sufficient to seek project implementation funding. The work will build on retrofit prioritization work by WSDOT, King County and others, and will be replicable in other urban and suburban areas around the Sound.~~

Performance measure: RFP issued by August 2012; new regional stormwater retrofit prioritization process and list of projects by December 2013.

C2.3 NTA 2: Map, Prioritize, and Restore Degraded Streams. King County, in cooperation with agencies populating the Puget Sound Stream Benthos database, will identify and map stream drainages with ~~“fair”~~ B-IBI scores ~~considered “fair” or worse~~, and develop a prioritized list, strategies and actions to improve scores of 30 of these streams.

Performance measure: Map of targeted drainages by March 2013; prioritized list for restoration and strategies, actions, and budgets by September 2013.

C2.3 NTA 3: Legacy Pollutant Removal. Ecology, in cooperation with local governments, will provide guidance and financial assistance to local governments to help them remove legacy pollutant loads from their stormwater systems.

Performance measure: Shared guidance; financial assistance to permittees by December 2013.

C2.3 HC 4: HCCC Stormwater Retrofit Program. HCCC will pursue a stormwater retrofit program to identify, ~~and~~ prioritize, and implement stormwater retrofit opportunities throughout the Hood Canal watershed.

Performance measure: By the end of 2013 a list of prioritized stormwater retrofit projects will be available to determine feasibility for implementation

C2.3 WS 5: West Sound Stormwater Retrofit Projects. By December 2015, Kitsap County Surface and Stormwater Management Program, in coordination with jurisdictions and other partners, will design and construct high priority retrofit projects treating 10 acres of pollution generating impervious surfaces.

Performance measure: By December 2015 treat 10 acres of impervious surface.

Comment [KG8]: Changes from Stormwater SI sub committee

“This amendment broadens the NTA, so that the prioritization process is not limited solely to the four-county area.”

Comment [KG9]: Edits from Snoqualmie Tribe

“If we focus only on streams with “fair” scores, we may miss out on opportunities that could have greater benefit than projects that might be selected simply based on their “fair” score. Why not use a benefit/priority analysis on the front end to determine if some degraded streams (e.g. waterbodies characterized as “poor” condition) might provide relatively greater benefits from near-term actions, for example, certain streams with known disproportionately high Chinook or other salmonid use. Working on these type streams, even if they are currently characterized as worse than “fair” through B-IBI, could provide more “bang for the buck” than some “fair” waterbodies.”

C2.4 Control sources of pollutants.

Stormwater runoff from urban and rural areas is a significant source of toxics, nutrients, and pathogens delivered to Puget Sound. (Even small concentrations of polluted runoff can be harmful to fish and other aquatic life.)

Proper control and treatment of this stormwater, as discussed in earlier strategies and actions, is critical to Puget Sound recovery. It also is important to reduce the amount of contamination that becomes caught up in the stormwater stream. Many pollutants, such as dissolved metals, are very expensive and difficult to remove from the stormwater stream through treatment BMPs. Other pollutants, like pathogens, are commonly found in stormwater, and, like other pollutants, cause problems in receiving waters. It is far more cost-effective to minimize the introduction of pollutants to stormwater than to rely only on stormwater flow control and treatment. This sub-strategy includes on local pollution and control programs; inspections, technical assistance, and enforcement; and development and implementation of total maximum daily loads (TMDLs).

- **Local Pollution and Control Programs:** Local programs should be developed and implemented to identify, track and control/eliminate sources of stormwater-related pollutants. Local governments need guidance and ongoing financial assistance to carry out this work. In addition, pollution identification and correction programs are discussed more fully in C.9.4.
- **Inspections, Technical Assistance, and Enforcement:** Needed work includes carrying out periodic inspections of businesses and industries with high likelihood of discharging pollutants of concern, working with property owners & operators to use best management practices to reduce discharges, and using technical assistance, incentives and enforcement to achieve compliance. Information from local pollution identification efforts, watershed plans, and regional monitoring activities should be used to identify pollutant hotspots/areas to restore. Local governments need guidance ongoing financial assistance to carry out this work. In addition, strategies and actions related to source control of toxics are discussed in Strategy C.1.
- **TMDLs:** Water quality implementation plans to eliminate impairments to water quality from stormwater discharges need to be developed and implemented. TMDLs need to contain monitoring, and follow up work should be conducted to ensure plans are achieving goals. Local governments need guidance and ongoing financial assistance to carry out this work. In addition, strategies and actions related to TMDLs are described more fully in ~~C9.1~~ 1.

Ongoing Programs

Local governments carry out source control actions through their illicit discharge detection and elimination programs (a requirement in all NPDES municipal permits). These programs can be effective tools to identify and address sources of illegal discharges to stormwater systems. In addition, NPDES phase I permit holders are required to run source control programs, which can lead to reductions in pollutants running off properties through site visits, assistance, and enforcement (when needed).

Near-Term Actions



C2.4 NTA 1: ~~Compliance Assurance Program~~ **Inspection, Technical Assistance, and Enforcement.** Ecology and local governments will increase inspection, technical assistance, and enforcement programs for high-priority businesses and at construction sites.

Performance measure: Increased number of inspections, technical assistance, and enforcement activities by December 2012.

- C2.4 NTA 2:** **Vehicle Leak Detection Program.** King County, in cooperation with Seattle, WSDOT, the STORM advisory committee, and PSP will lead a regional discussion to develop options and recommendations for a new program to inspect and eliminate privately owned vehicle drips and leaks by June 2014. This work builds on the related work of existing grants to STORM and Seattle on vehicle leaks and drips.

Performance measure: By September 2012 convene first forum. By December 2013, convene up to three additional forums and use information from the STORM and Seattle grant-funded efforts to identify opportunities, challenges, options and recommendations. By June 2014, complete a recommendation report for policy changes, public education and behavior change campaigns, and funding needs, and present recommendation report to the ECB, Science Panel, and Leadership Council for consideration. By September 2014, based on feedback from the ECB and Leadership Council, PSP will work with regional partners to identify a lead for next steps and measures.

- C2.4 SJI 5:** **SJI Coordinated Best Management Practices.** San Juan County Public Works will convene Community Development and Planning Department (CDPD), Department of Health and Community Services (DHCS), and the San Juan Islands Conservation District (CD) to identify and coordinate best management practices for stormwater, on-site septic systems, and animal wastes with community participation by 2013.

Performance measure: CDPD, DHCS, CD, and the Town of Friday Harbor will publicize information by the second quarter of 2014 at the DHCS, CDPD, and Town permit counters and associated websites, with a goal to target 100% of applicants by the end of 2014. San Juan County will provide for identified best management practices in County Code by 2014.

- C2.4 SJI 6:** **SJI Stormwater Monitoring.** San Juan County Public Works Stormwater Utility will lead and work jointly with the Stormwater Committee, the Water Resources Committee, the Marine Resources Committee, and the Town of Friday Harbor to implement an annual strategic monitoring plan by 2013 to measure levels of fecals, heavy metals, POPs, and PAHs in priority basins.

Performance measure: In the first year post-implementation, monitor 100% of priority basins, with monitoring actions ongoing after 2014.

C2.5 Provide focused stormwater-related education, training, and assistance.

Cities and counties rely on a variety of education, training and technical and financial assistance resources to deliver effective local stormwater management programs. By providing these resources, in addition developing supplementary guidance and model ordinances, stormwater can be more effectively managed throughout the region.

Focused information, education, and training on stormwater-specific issues should be provided for multiple audiences:

- **Citizens (especially homeowners):** Importance of problem, sources of contaminants and effects, their role in helping to solve problems.
- **Legislators and elected officials:** Issues, funding needs, results of significant studies and reports, product bans & phase-outs.
- **Local government staff:** Training on permit activities, including inspections and maintenance, source control, spill response, and LID implementation.
- **Businesses:** Source control training, best management practices, proper material disposal, and other technical assistance.

A variety of techniques, such as sharing of science and research, social marketing, prioritization of issues and contaminants, media with vetted messages, proven BMPs and program strategies, classes, and training workshops should be used.

Support for and participation in Puget Sound Starts Here (PSSH), STORM and other regional programs designed to facilitate coordination and implementation of municipal stormwater public education & stewardship programs should be encouraged. Transportation-related topics need to be included in this effort.

Ongoing Programs

The Partnership, Ecology, local governments, Washington Sea Grant, WSU Extension, and non-profit organizations carry out a broad stormwater-focused behavior change campaign. These programs emphasize problems, sources, solutions and roles, funding needs, and stormwater management on residential properties.

Puget Sound Starts Here is a partnership of local governments, PSP, Ecology, and local organizations that are part of the Partnership's ECO-Network. PSSH leverages the combined investments of all these organizations and provides consistent public awareness and education messages across the twelve-county Puget Sound region. Using state-of-the-art communications techniques, it provides a regional communications umbrella to support and enhance the effectiveness of local stormwater program delivery.

The Washington Stormwater Center serves as a central resource for integrated NPDES education, permit technical assistance, stormwater management and new technology research, development, and evaluation.

Near-Term Actions



C2.5 NTA 1: **LID Training and Certification.** Ecology will provide focused training for local government staff on LID project review, and inspections and approvals, as well as to local government staff and private sector on maintenance. Develop new professional certification for stormwater maintenance specialists. Provide business staff and

contractors with training on source control, spill recognition, spill response, and erosion control.

Performance measure: Provide stormwater-related training by June 30, 2013 and follow-up training opportunities by June 30 2014.

In addition, actions related to stormwater-focused education are described in D7.



C2.5 NTA 2: [WHO] develops a near-term plan for academic course work, including tribal history and civics, for future stormwater professionals that emphasizes continuing improvements in stormwater management in the context of the larger issues of sustainable water resource management and climate change.

Performance measure: TBD.

C2.5 WS 4: West Sound LID Training. By December 2014, Kitsap County Surface and Stormwater Management Program – with direct assistance from and close coordination with other stormwater utilities and agencies in the County – will provide training for 80% of LID professionals in Kitsap County, including plan review staff, designers, installers, inspection, and maintenance staff.

Performance measure: Training for 80% of LID professionals in Kitsap County by December 2014.

Comment [KG10]: New NTA from Habitat SI subcommittee

“This new NTA emphasizes the need to plan for the next generation of stormwater professionals, and move toward incorporating a watershed approach into education curriculum. The action would provide long-term support for watershed-based restoration by building on a curriculum already started in some community colleges.”

Emerging Issues and Future Opportunities

- More explicitly incorporate climate change information and state climate adaptation strategies into Puget Sound stormwater strategies. This includes downscaled climate projections for streamflows, sea level rise and salt water intrusion, as well as consideration of extreme weather events for planning, designing and siting stormwater infrastructure. Examples include prioritization criteria for retrofits and adaptation of basin-scale hydrologic models.
- Additional local governments should be evaluated for coverage to bring more land area under the NPDES permits over time.
- Providing LID training at colleges.

Target View: Insects in Small Streams

Runoff from developed lands and clearing of trees along waterways can harm the health of small streams that support salmon, other aquatic life, and wildlife. Water insects (benthic macroinvertebrates) are an indicator of biological health of stream systems, and a common method for quantifying this indicator is the Benthic Index of Biotic Integrity (B-IBI), which produces a numerical value to indicate a stream's ecological condition.

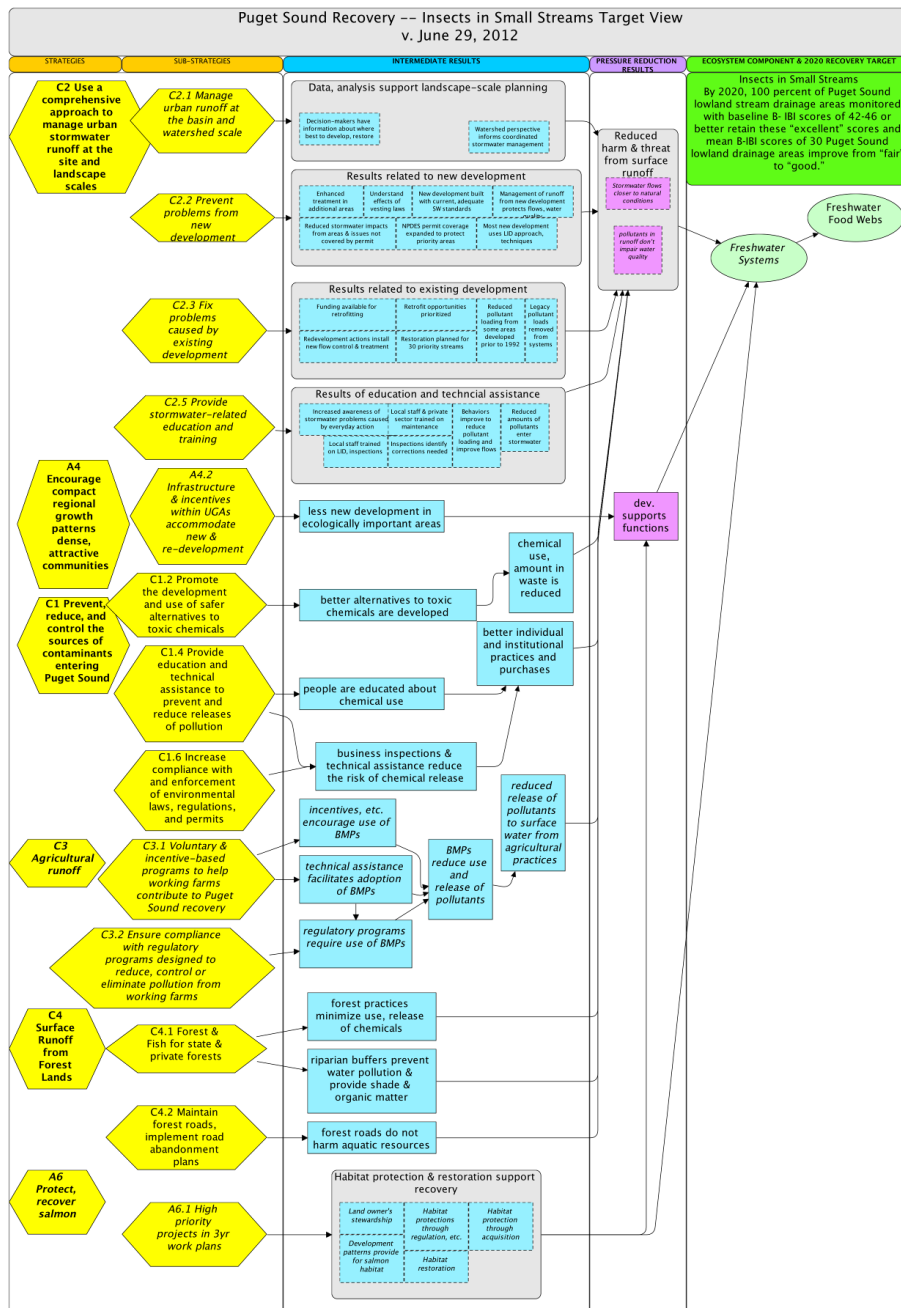
The 2020 recovery target related to urban runoff is for 100 percent of Puget Sound lowland stream drainage areas monitored with baseline B-IBI scores of 42-46 or better to retain these "excellent" scores and mean B-IBI scores of 30 Puget Sound lowland drainage areas improve from "fair" to "good." Further information on the B-IBI scoring system is available at the Puget Sound stream benthos website (www.pugetsoundstreambenthos.org), an ongoing project to store and analyze data from macroinvertebrate sampling programs. Sound-wide results have not been reported, but King County data show that about 37 percent of sites are rated "good" or "excellent" with the remaining 63 percent rated "fair" or "poor."

The Action Agenda strategies most related to achieving the recovery target for urban runoff are:

- Provide infrastructure and incentives to accommodate new and re-development within urban growth areas (A4.2)
- Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales (C2.1, C2.2, C2.3, C2.5)
- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.2, C1.4, C1.6)
- Implement high priority projects identified in each salmon recovery watershed's 3-year work plan (A6.1)
- Prevent, reduce, and control agricultural runoff (C3.1, C3.2)
- Manage Prevent, reduce, and control surface runoff from forest lands (C4.1, C4.2)

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In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.



Prevent, Reduce, and Control Agricultural Runoff

The Challenge

Improperly managed surface water runoff from farms can convey a variety of pollutants to groundwater and Puget Sound. These pollutants include sediment, pathogens, pesticides and other chemicals, and excess nutrients. Nutrients can pose particular risks because they can support and enhance production and accumulation of algal blooms. As the algae die and decompose, they deplete the water of available oxygen, contributing to the death of aquatic organisms, such as fish and shellfish. In Puget Sound, inlets with few freshwater inputs and deep basins that have limited exchange with surrounding waters such as South Puget Sound and Hood Canal are particularly vulnerable. Excess nutrients can also contaminate drinking water from both surface and groundwater sources.

Agricultural and rural areas constitute about 30-35 percent of the Puget Sound, these lands include commercial agriculture, small farms, and rural development and they can produce significant sediment, nutrient, pathogenic, and chemical loads to stormwater through non-point sources. Strategies in this area seek to provide both incentives and tools to farmers to help them apply best management practices to improve the quality of surface water runoff, while ensuring that working farmland can be maintained and agriculture in the Puget Sound remains economically viable. Particularly challenging are the large number of small acreage farms. These farms typically contain small numbers of animals, including cows, horses, sheep, or goats. Wastes from these animals, if not properly managed can be a significant source of polluted runoff. Small agricultural operations such as those found in many areas of Puget Sound may not meet eligibility requirements for federal incentive programs.

Maintenance of agricultural land also is critical. Strategies and actions oriented towards protection and stewardship of ecologically sensitive rural and resource lands and maintaining the vibrancy of agriculture are discussed in A3.3.

Climate Change

Declining snow pack and loss of natural water storage, changes in precipitation timing may likely exacerbate runoff concerns from agricultural lands. A high priority overarching response strategy identified in *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy* (April 2012) directly relates to runoff:

- **Safeguard fish and wildlife and protect critical ecosystem services that support human and natural systems.** This includes reducing existing stresses on fish, wildlife, plants, and ecosystems. Reducing polluted runoff improves water quality and aquatic habitat, thereby increasing the resilience of aquatic species to additional stresses from climate change.

Implementing the agricultural runoff strategy in the Action Agenda helps prepare for climate change.

SALMON RECOVERY

Agricultural Runoff – A Salmon Recovery Plan Priority: As described in Action Agenda Section C2, improvement in water quality is identified in the salmon recovery plan with a call to resolve uncertainty about whether the regional water quality actions address the needs of salmon. Volume I identifies general concerns related to stormwater runoff. Several watershed chapters specifically mention rural runoff from areas such as agricultural lands as needing to be addressed.

How these priorities are integrated: The Action Agenda contains more detailed strategies and actions to address rural runoff than the Salmon Recovery Plan. More work is needed to address rural run-off priorities as identified in the specific watershed chapters. In addition, the resolution about the effectiveness of actions still needs to be addressed.

Relationship to Recovery Targets

Reducing pollution from agricultural lands is part of the overall effort to achieve recovery targets for freshwater quality, shellfish bed recovery, freshwater aquatic habitat, swimming beaches, dissolved oxygen in marine waters, eelgrass recovery, and marine sediment quality.

Local Priorities

Controlling and managing agricultural runoff is generally identified as important in the Skagit and Stillaguamish-Snohomish Watersheds. Both areas note the importance of working cooperatively with the farming community.

C3. Prevent, reduce, and control Agricultural runoff

C3.1 Target voluntary and incentive-based programs that help working farms contribute to Puget Sound recovery.

Numerous programs, guidelines and technical assistance opportunities exist to help farmers identify potential pollution impacts from farming activities and implement best management practices to reduce, control or eliminate pollution.

For example, Conservation Districts (CD) and local United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) offices currently work with farmers to develop voluntary Farm Management Plans (farm plan). A farm plan identifies the resources on the property and the possible impacts to those resources from agricultural activities, identifies the practices the landowner

can undertake to correct these impacts, and identifies the state or federal funding programs the landowner may apply for in order to help implement the practices. If the landowner chooses to implement the practices consistent with the plan, the landowner will address the resource impacts. The practices a landowner might undertake include streamside fencing, manure composting, pasture renovation, and weed management techniques. The planning evaluates site specific characteristics such as the size of the farm, types of soil, slope of the land, proximity to streams or water bodies, types of livestock, or crops, resources such as machinery or buildings, and available finances. Once the farmer decides what changes he or she wants to make on their property, they work with the local Farm Planner to set a tentative implementation schedule.

Another program to address impacts to water quality due to agricultural activities is the Conservation Reserve Enhancement Program (CREP). CREP is administered by USDA's Farm Service Agency (FSA) and is a voluntary program that helps farmers protect environmentally sensitive land, decrease erosion, restore wildlife habitat and safeguard ground and surface water resources. Under CREP, eligible farmers can receive financial compensation when they enter into ten to fifteen year contracts to keep valuable resource land out of production and technical and financial assistance (up to fifty percent) to install restoration measures such as riparian plantings along streams.

These incentive-based programs, publicized by local programs, CDs and NRCS, are currently implemented in an "opportunistic" manner – that is, the landowner seeks out their local CD or Washington State University (WSU) Extension staff for information and assistance. Consequently, service delivery is not targeted to specific locations to address specific resource concerns, such as degraded riparian areas and water quality. These programs can be better targeted to address priority resources concerns and better coordinated with regulatory efforts to make them more effective.

Ongoing Programs

The primary objective of these actions is to enhance the targeting of ongoing landowner incentive programs to address specific resource concerns on commercial and non-commercial farms. In order to better target voluntary, incentive, and technical assistance programs and promote their use in Puget Sound, the State Conservation Commission has worked with all the Puget Sound Conservation Districts to develop a Puget Sound Conservation District Action Agenda. This document links the work of the 12 Conservation Districts in the Puget Sound basin to the specific threats identified by the Puget Sound Partnership. Funding is then provided by the State Conservation Commission to the CDs to implement on-the-ground activities that address the identified threats. In this way, specific CD work and landowner activities can be directly linked to specific Puget Sound threats.

The State Conservation Commission (Conservation Commission) also is working with counties and other state agencies to implement the Voluntary Stewardship Program (VSP). This new program is intended to address the contentious issue of the protection of critical areas on agricultural lands while maintaining viable agricultural production. The VSP provides counties with an alternative to protecting critical areas from agricultural activities through the Growth Management Act process. If they decide to opt-in, counties must identify, in accordance with specified criteria, watersheds that will participate in the VSP and nominate, watersheds for consideration by the State Conservation Commission as state priority watersheds.

Once a county has opted-in to the VSP and funding is made available, the county must also identify a watershed group to develop a work plan that will identify how critical areas in the watershed will be

protected in the context of agricultural activities. The work plan is submitted to the State Conservation Commission for approval in consultation with affected state agencies. The work plan must include measureable goals and benchmarks for the protection of critical areas. The watershed group must show progress on these goals and benchmarks every five years, or implement adaptive management if progress is not being made.

Near-Term Actions

C3.1 NTA 1: Water Quality Best Management Practices. By December 2012, the Department of Ecology, Department of Agriculture and State Conservation Commission, after conferring with federal, tribal, and local partners will work on a solution to improved implementation of best management practices that protect water quality.

Performance measure: By December 2012 develop a plan to improve BMP implementation.

C3.1 NTA 2: Effectiveness of Incentive Programs. By December 2013, the State Conservation Commission, in consultation with Ecology and the Washington State Departments of Agriculture and Health, Conservation Districts, federal agencies and tribes, will report to the Governor and the Legislature on the effectiveness of incentive programs to achieve resource objectives. The report will include a section from Ecology on compliance with water quality standards.

Performance measure: By December 2012, hold two coordinating meetings to evaluate the effectiveness of the agriculture incentive programs. By June 2013, produce a draft report with recommendations on necessary changes. Between June 2013 and November 2013, present the draft report to the agencies, tribes, and stakeholder groups for comment. By November 2013 present the report to the ECB and Leadership Council. Following presentation of the final report to the legislature and governor, the WSCC will work with the other entities on strategies to implement the recommendations in the report.

C3.1 NTA 3: Voluntary Stewardship Program. The Conservation Commission, Ecology, and WSDA should support implementation, funding, and assistance to those Counties participating in the Voluntary Stewardship program, as well as new capacity for enforcement of state and federal water quality regulations.

Performance measure: By December 2012, the WSCC will identify potential funding sources. By June 2013, funding will be made available to the four counties in the Program.

In addition, actions associated with Washington State departments of Ecology, Health, WSDA, and the Conservation Commission in identifying priority areas for implementation of voluntary, incentive, and technical assistance programs for rural unincorporated landowners, small acreage farms, and other working farms are described in A3.1.

C3.2 Ensure compliance with regulatory programs designed to reduce, control, or eliminate pollution from working farms.

The Washington Water Pollution Control Act, RCW 90.48, administered by the Department of Ecology (Ecology), prohibits the discharge of pollutants from all lands in the state, including agricultural lands. The Washington State Department of Agriculture (WSDA) inspects dairy operations and ensures their compliance under the Dairy Nutrient Management Act, RCW 90.64.

Ongoing Programs

Ecology has the responsibility to control and prevent the pollution of streams, lakes, rivers, ponds, inland waters, salt waters, watercourses, and other surface and underground waters of the State of Washington. Ecology also is authorized to provide grants to address pollution problems.

Ecology identifies priority areas for work to address agricultural runoff through a variety of processes, including ambient monitoring and the state Water Quality Assessment, which lists the impaired waters in the state. To address these impaired waters, Ecology may develop a Total Maximum Daily Load / Water Cleanup Plan or may work to directly implement the practices necessary to solve the water quality problems. In many cases, incentive and technical assistance programs are available to help land owners identify and implement best management practices; some of these programs provide financial assistance. Ultimately, Ecology uses a combination of tools – education, technical and financial assistance, and compliance actions to ensure water quality standards are met. In conducting this work, Ecology often works with and may provide funding for other entities such as CDs or WSU Extension.

Water quality best management practices (BMPs), referenced by RCW 90.48, is a legal term that refers only to those combinations of pollution controls used to prevent and control water pollution that achieve compliance with water quality law. Regulations in Washington State specifically define water quality BMPs as those approved by the Department of Ecology (WAC 173-201A-020), and those that are applied to attain compliance with the water quality regulations (WAC 173-201A-510).

Dairies must control the use of nutrients and limit bacteria discharge on their dairy operations in order to eliminate runoff from their fields getting into surface water or to minimize leaching into groundwater. Nutrients and bacteria may come from dairy manure, commercial fertilizer or other non-agricultural sources. Nutrient controls are intended to prevent nutrients from reaching surface water and thus helps to prevent reductions of dissolved oxygen or changes in pH. Bacteria controls are intended to prevent bacteria from reaching surface water which protects human health from harmful organisms, and supports safe shellfish production. Preventing nutrients and bacteria from reaching groundwater protects human health from contaminated drinking water and protects surface water from potential contamination through hydraulic connectivity between groundwater and surface water.

To protect Puget Sound from dairy discharges of nutrients and bacteria, WSDA inspects all dairies and identifies those that have infrastructure conditions or management practices that may result or have the potential to discharge nutrients and bacteria to waters of the state, both surface and ground. If risks are identified, WSDA works with the dairy operation to identify structural improvements or changes in management practices that will reduce and eliminate the risk of discharge. WSDA inspections may include referrals to technical assistance agencies or may result in enforcement when needed.

WSDA inspections evaluate dairies to ensure that operators properly collect, transfer, treat and store manure and contaminated water. Proper collection, handling and storage of dairy generated manure and wastewater and protect water of the state and Puget Sound from nutrient and bacterial contamination. WSDA evaluates nutrient management on dairies by reviewing the dairy's soil tests, their nutrient application timing, methods, locations, amounts, and the crops grown on their fields. WSDA monitors the nutrient levels and operators response in management from year to year and takes compliance actions as needed. This recordkeeping requirement helps the dairy operator to focus on applying just enough nutrients for their fields in each growing season. Fall soil tests show how much nitrogen and phosphorus are left on fields after crop removal and thereby help inform the operator on management adjustments for future improvements.

Finally, there is a specific permit focused on addressing pollution from animal feeding operations. The Concentrated Animal Feeding Operation (CAFO) National Pollution Discharge Elimination System (NPDES) permit is administered by Ecology. This permit is required for all animal feeding operations that discharge to waters of the state. Animal feeding operations are defined as operations that confine and feed animals for a total of 45 days or more in any 12-month period where vegetation or post harvest residues are not sustained in the normal growing season over any portion of the facility where animals are confined. Ecology's work implementing the CAFO permit is focused on ensuring that manure is stored, handled and applied properly and at agronomic rates to prevent discharges to surface and groundwater. This includes discharges from application fields, waste storage facilities and animal confinement areas.

Near-Term Actions



C3.2 NTA 1: Priority Areas for Voluntary Incentive and Regulatory Programs. The State Conservation Commission and the Washington State Departments of Agriculture, Ecology, and Health will identify priority areas to better target and coordinate implementation of voluntary incentive and regulatory programs for rural landowners, small-acreage landowners, and working farms.

Performance measure: By Dec. 31, 2012, the WSCC will convene at least two meetings to identify priority areas. By June 30, 2013, WSCC will implement voluntary incentive programs in 5 target areas.

C3.2 NTA 2: Dairy Lagoon Assessment. By July 2013, WSDA will complete the current NRCS-funded lagoon assessment of all known dairy waste storage ponds, finalize risk based evaluations and prioritize lagoons based on the findings. The assessment ranks lagoons on potential risk to water resources. Lagoons identified as high risk will be provided technical assistance to address the problem.

Performance measure: Field assessment and risk evaluation of up to 500 lagoons completed by July 2013; Number of lagoons with identified risks are identified and operators made aware of available technical assistance by September 2013.

C3.2 NTA 3: Dairy Rule Final Agronomic Applications. By December 2012, WSDA will adopt a final rule defining records required by dairies to show agronomic applications (Chapter 90.64.010(17)) and create a penalty matrix for both discharge and records violations.

Rule adoption supports efficient program implementation by clarifying for dairies and stakeholders the expectations for recordkeeping as well as the basis for penalties.

Performance measure: Final rule adopted or not.

C3.2 NTA 4: CAFO Permit. By December 2012, Ecology will issue an updated CAFO permit.

Performance measure: Estimated Public Comment Draft Date: July 2012; Estimated Permit Issuance Date: November 2012; Estimated Permit Effective Date: December 2012.

Emerging Issues and Future Opportunities

Reducing nutrient pollution in Washington State, particularly in areas like parts of Puget Sound where harmful algal blooms and depressed oxygen levels affect both aquatic life and human use and health, is important.

Currently, only dairies or facilities covered under the CAFO permit have requirements and oversight to control nutrient applications. Monitoring nutrient applications from all sources, including manure, fertilizer, tilled-in cover crops, and other organic soil amendments is needed in Washington State to ensure beneficial application of nutrients are conducted.

Existing technical assistance to agricultural operators should be augmented with focused nutrient management education to third-party applicators of manure and fertilizers as well as major crop growers. The objective should be to increase awareness across the industry sectors of the importance of accounting for all nutrient sources, of making necessary applications at the right time, in the right place, in the right form and in the right amount. In addition, education on field conditions and appropriate measures to take to prevent runoff into adjacent or nearby surface water should also be communicated to landowners and applicators. The dairy industry has found savings in their fertilizer costs by better accounting of all sources; there may be similar economic advantages for other agricultural growers.

Manure handling and storage of manure solids can include periodic transport from manure generators to crop fields for stockpiling in preparation for spreading at a later time. Manure is an important source of crop nutrients and improves soil health. Continued export of manure to crop growers is an important element of sustainable agricultural practices and economy. However, improper transport and stockpiling can result in runoff of nutrients and bacteria as well as cause nuisance issues related to odor. Only dairies currently have regular oversight on this practice. Existing technical assistance to agricultural operators should be augmented with focused education to third-party haulers and applicators of manure as well as major crop growers on handling and storage. Discussions among agencies may be appropriate to review current standards for potential improvements in the standard as well as implementation.

Target View: Dissolved Oxygen in Marine Waters

One important measure of water quality and a component of the Marine Water Condition Index is the amount of dissolved oxygen in the water. Fish, crabs, and many other species living in Puget Sound need oxygen to survive. As dissolved oxygen decreases, animals become stressed. When levels of dissolved oxygen get too low, fish and other animals may die, often in widespread "fish kills." An over abundance of nitrogen can be a major cause of low dissolved oxygen since it fosters growth in marine plants and algae. When these plants and algae die, their decay robs the water of oxygen. Nitrogen occurs naturally in water, but we also add more through discharge from wastewater treatment plants, septic systems, and run-off from developed and agricultural lands. One way we can improve marine water quality is to reduce the amount of nitrogen we contribute from these sources. Linking the amount of nitrogen pollution from humans to the growth of algae and the amount of dissolved oxygen is critical to protecting water quality.

The 2020 recovery target for improving water quality is to keep dissolved oxygen levels from declining more than 0.2 milligrams per liter (mg/L) in any part of Puget Sound as a result of human inputs.

Because dissolved oxygen concentrations are a result of many natural and human influences, we cannot simply measure dissolved oxygen and understand how much humans contribute directly. This target requires a combination of monitoring data, studies on the sources of nitrogen and sophisticated mathematical models to determine whether human inputs are contributing to a decline in dissolved oxygen.

The Washington Department of Ecology and others are currently working on such studies. Initial results will be available sometime in late 2012. At that time we will understand whether humans contribute to low levels of dissolved oxygen and what management actions may be necessary to address them. In the future we will update these results using better models and more recent estimates of nitrogen loads coming into Puget Sound. Together, model assessments and the Marine Water Condition Index will be used to track current conditions and long term changes in dissolved oxygen and overall water quality of Puget Sound.

Ecology's Marine Water Condition Index

Annual, 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Admiralty Reach	20	13	8	4	0	-5	-3	-6	3	1	-7	-4
Georgia Basin	-2	14	13	-2	-2	10	-2	-7	2	9	-10	7
South Hood Canal	16	7	9	2	-4	-8	-1	-12	6	10	-1	-13
Central Basin	15	14	12	8	0	-6	-9	-3	4	1	-7	-11
Bellingham Bay	10	13	23	-3	1	6	-13	-10	7	2	-12	-14
Sinclair Inlet	8	16	13	0	-1	-5	-6	-10	3	1	1	-14
Oakland Bay	16	13	14	-1	-6	-10	-5	1	3	-3	-2	-7
South Sound	19	14	14	-6	4	0	-5	-2	3	0	-8	-12
Elliot Bay	28	19	5	-4	-9	3	-16	-9	3	3	-6	-6
Commencement Bay	17	8	13	-3	-6	-1	-4	-1	6	-4	-8	-8
Whidbey Basin	11	8	8	-6	-2	-10	-1	-1	8	7	-9	-13
Budd Inlet	8	14	17	1	-12	-9	-7	-1	8	4	0	-9

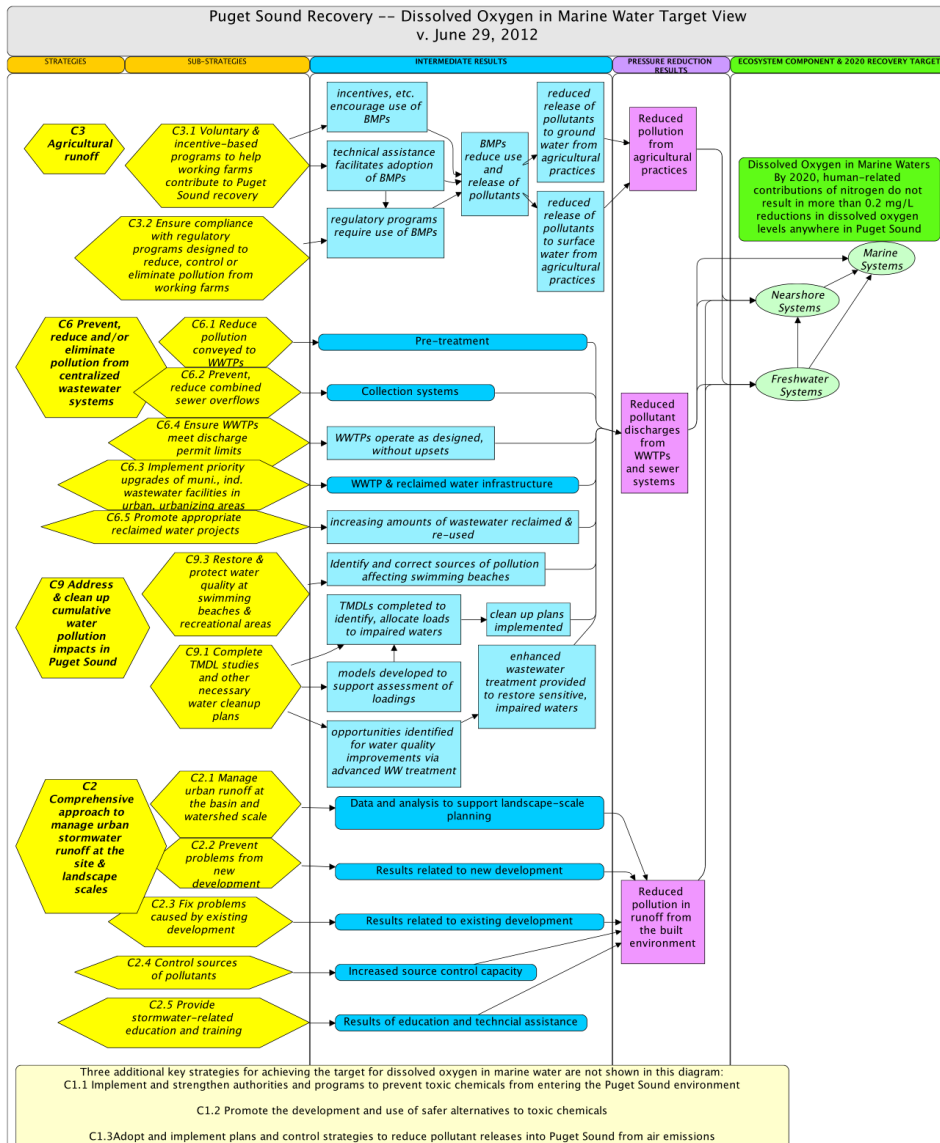
Source: Marine Monitoring Unit, Washington State Department of Ecology

The Marine Water Condition Index combines measurements relevant to water quality in Puget Sound. Changes in water quality are reported with numbers greater than zero indicating improving water quality in green and numbers smaller than zero indicating decreasing water quality in red. Although the index is well suited to track changes in water quality in Puget Sound it cannot be used to identify the specific sources of human contribution that are causing poor water quality.

The Action Agenda strategies most related to achieving the recovery target for dissolved oxygen in marine waters are:

- Manage-Prevent, reduce, and control agricultural runoff (C3.1, C3.2)
- Prevent, reduce and/or eliminate pollution from centralized wastewater systems (C6.1, C6.2, C6.4, C6.3, C6.5)
- Address and clean up cumulative water pollution impacts in Puget Sound (C9.2, C9.1)
- Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales (C2.5, C2.4, C2.1, C2.3, C2.2)
- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.1, C1.2, C1.36)

In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.



Prevent, Reduce, and Control Surface Runoff from Forest Lands

The Challenge

Approximately 60-65 percent of the Puget Sound basin is forested land. A significant amount of this area is being actively managed for timber production (non-national park/wilderness areas). Surface runoff from forestry, particularly forest roads, stream crossings, delivery of water from road ditches and the capturing of seeps and springs as part of road cuts, has the potential to deliver excess sediment to streams. Forest harvesting also has the potential to affect the hydrology of a watershed, by affecting evapotranspiration rates; and as a result of skid trails, yarding corridors and harvesting near unstable slopes.

In Washington State, forest practices are regulated under the [Forest Practices Act](#), established by the legislature, and by the rules adopted by the [Washington Forest Practices Board](#) (the Board). The most recent significant change in rules was adopted in July 2001. The 2001 rules were informed by the Forests and Fish Report, which was the product of a multi-stakeholder effort to recommend improvements to forest practices that would protect water quality and the aquatic and riparian habitat associated with fish and riparian dependent amphibians on forestlands.

The forest practices program meets the requirements of Endangered Species Act (ESA) through establishing rules that are designed to meet the Forest Practices Habitat Conservation Plan (FPHCP). In addition, the forest practices program, as guided by a well funded and robust adaptive management program, was intended to bring these forested waters into compliance with state and federal water quality requirements. Through meeting the Forest Practices Habitat Conservation Plan (FPHCP) and the Clean Water Act requirements, the State of Washington seeks to provide long-term conservation of covered species by restoring and maintaining riparian habitat on non-federal forestland, meeting water quality standards and supporting an economically viable timber industry.

Climate Change

Declining snow pack and loss of natural water storage, changes in precipitation timing may likely exacerbate runoff from forests. A high priority over-arching response strategy identified in *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy (April 2012)* directly relates to runoff:

- **Safeguard fish and wildlife and protect critical ecosystem services that support human and natural systems.** This includes reduce existing stresses on fish, wildlife, plants, and ecosystems. Reducing polluted runoff improves water quality and aquatic habitat, thereby increasing the resilience of aquatic species to additional stresses from climate change.

Implementing the forest runoff strategy in the Action Agenda helps prepare for climate change.

SALMON RECOVERY

Forest Land Runoff – A Salmon Recovery Plan Priority: As described in Action Agenda Section C2, improvement in water quality is identified in the salmon recovery plan with a call to resolve uncertainty about whether the regional water quality actions address the needs of salmon. Volume I identifies general concerns related to stormwater runoff. Several watershed chapters specifically mention rural runoff from areas such as forest roads as needing to be addressed.

How these priorities are integrated: The Action Agenda contains more detailed strategies and actions to address rural runoff than the Salmon Recovery Plan. More work is needed to address rural run-off priorities as identified in the specific watershed chapters. In addition, the resolution about the effectiveness of actions still needs to be addressed.

Relationship to Recovery Targets

Management of runoff from forest lands is part of the overall effort to achieve recovery targets for freshwater quality, shellfish bed restoration, reduction of toxics in fish, and marine sediment quality.

Local Priorities

Controlling forest runoff is not specifically called out as a high priority for local integrating organizations. Hood Canal has general priorities that include implementing and monitoring the effectiveness of Forest Practices HCPs and similar agreements and USFS Northwest Forest Plan and Access and Travel Management Plans.

C4. Prevent, reduce, and control surface runoff from forest lands

C4.1 Achieve water quality standards on state and privately owned working forests through implementation of the Forest and Fish Report.

In 1999 the Forest and Fish Report included Clean Water Act (CWA) assurances granted by Washington State Department of Ecology (Ecology) with the expectation that by 2009, research and monitoring would demonstrate that water quality standards would be achieved or a trend towards that achievement identified. In 2009 Ecology found there was insufficient data and information to substantiate the assurance that water quality standards were being achieved in working forests. At the same time, Ecology also found that the Forest and Fish program, even with its challenges, creates a well-established foundation for achieving full compliance with the water quality standards. Ecology extended

CWA assurances, conditioned on achievement of 21 program milestones, with some scheduled to be completed by as late as 2019. These include:

- Support rules and funding to implement the Forest and Fish Report
- Support an adaptive management program to update rules and guidance as necessary, with particular focus on water quality-related rules
- Consistent compliance and enforcement of Forest Practices Rules
- Bring roads up to design and maintenance standards

Recent Progress

As of August 2011, 10 of the 21 program milestones have been completed. Washington State Department of Natural Resources (DNR), Ecology, and the Forests and Fish cooperators continue to make progress on completing key milestones towards maintaining CWA Assurances.

One of the main constraints to accomplishing the milestones on schedule is personnel capacity and funding limitations at DNR and other agencies and partners in the implementation of the Forest and Fish Report. The Forest Practices Program has experienced decreased funding in the last two biennial budgets, with an overall decrease of \$4 million in FY 09–11 and an additional \$2 million in FY 11–13 from state general funds. This represents a decrease of approximately 28 percent in state general fund appropriations, and has impacted DNR's ability to support the Adaptive Management Program (AMP), compliance monitoring, and enforcement of the Forest Practices Rules. Compounding the decreased state funding, exhaustion of federal funding from the Pacific Coastal Salmon Recovery grants occurred as of 2011.

Federal funding through the Pacific Coastal Salmon Recovery Fund supported a substantial portion of the Forest Practices AMP between 2000 and 2011. Averaging almost \$5 million a biennium, and spanning a period of ten years, this funding is no longer being provided by the federal government. These funds supported the development of tools to aid implementation of the Forests and Fish Report, and in the last six years, went almost entirely to support AMP research and monitoring. This loss of funding has created a serious challenge for the Forest Practices Program to meet AMP obligations. While those funding losses have been offset somewhat by the creation of the Forests and Fish Support Account by the Washington State Legislature to support tribal and non-governmental participation in the implementation of the Forests and Fish Report, this does not completely bridge program costs associated with the AMP.

Ongoing Programs

DNR is working to complete the remaining 11 milestones on a schedule to maintain CWA assurances from Ecology. Among those remaining, a few have been a particular challenge for DNR and its cooperators to complete due to funding and staffing resource limitations. These include obtaining an independent review of the AMP, training and certification of staff and cooperators, assessing the condition of small forest landowner roads, and completing the Cooperative Monitoring, Evaluation and Research (CMER) research that drives the science-based adaptive management process. In the coming years, DNR and the Forest and Fish Cooperators will continue to work towards these milestones. The operational and procedural milestones have completion due dates by 2013, while a schedule of CMER research studies stretches out through 2019.

Near-Term Actions

C4.1 NTA 1: Forest Practices Adaptive Management Program Review. DNR and Ecology will obtain an independent performance review of the Forest Practices Adaptive Management Program (AMP).

Performance measure: DNR identifies date for the review by December 2013.

C4.1 NTA 2: Forest Practices Adaptive Management Program. DNR will work to secure long-term and dependable funding for the Forest Practices Adaptive Management Program (AMP), training, compliance monitoring, and enforcement.

Performance measure: DNR identifies date for securing a stable base by December 2013.

C4.2 Maintain forest roads and implement road abandonment plans for working forest lands subject to the Forest Practices Rules on schedule, and ensure federal forest managers meet or exceed state standards for road maintenance and abandonment on federal lands.

Forest Practices Rules include road maintenance and abandonment provisions to prevent sediment and hydrology-related impacts to public resources such as water quality and fish habitat. The rules require large forest landowners to develop and implement Road Maintenance and Abandonment Plans (RMAP) for roads within their ownership. Large forest landowners are required to have all roads within their ownership covered under a DNR-approved Road Maintenance and Abandonment Plan (RMAP) ([WAC 222-24-051](#)) by July 1, 2006, and to bring all roads into compliance with forest practices standards by October 1, 2016 (or with approved extension by 2021). This includes all roads that were constructed or last used for forest practices since 1974. An inventory and assessment of orphaned roads (i.e., forest roads and railroad grades not used for forest practices since 1974) also must be included in the RMAP.

In an effort to minimize the economic hardship on small forest landowners (also known as family forest landowners), the 2003 Washington Legislature passed a Road Maintenance and Abandonment Plan bill (HB1095) that modified the definition of “small forest landowner” and specified how the road requirements applied to small forest landowners. Small forest landowners have the option to submit a “checklist” RMAP with each forest practices application or notification, rather than to provide a plan for their entire ownership. The RMAP checklist is a brief assessment of certain characteristics of roads proposed to be used under a forest practice application, and does not provide a complete inventory of the condition of all of the landowner’s forest roads. This means that specific roads on small forest landowner properties need not be brought up to current standards until they are being actively used for a forest practices activity.

To assist small forest landowners in achieving road maintenance requirements specific to fish passage, the legislature created the [Family Forest Fish Passage Program](#) (FFFPP) in 2003. FFFPP is a cost-share program that provides 75-to 100 percent of the cost of correcting fish barriers. The program is managed by three Washington State Agencies (Department of Natural Resources, Washington Department of Fish and Wildlife, and Recreation and Conservation Office).

The Federal Northwest Forest Plan has been in place since the mid-1990s and has dramatically lowered rates of timber harvest on federal lands within the range of the northern spotted owl. This has resulted in less timber revenue to support maintenance of federal forest roads. In 2000, the U.S. Forest Service Region 6 and Ecology signed a [Memorandum of Agreement](#) in which the U.S. Forest Service agreed to develop road maintenance and abandonment plans for all federal forest roads within five years (2005) and fully implement those plans within 15 years (by 2015). Yet, continued reductions in federal funding has created an estimated \$300 million (2005 dollars) shortfall in the funds needed to upgrade roads to current standards, repair fish passage barriers, and decommission roads no longer needed or supportable.

In November 2010, as part of implementation guidance on national regulations for [Travel Management Planning](#) the Deputy Chief for the U.S. Forest System set a target for each National Forest to complete plans that would “right size” the federal forest road system by 2015. Each unit of the National Forest System (NFS) is to: (1) identify the minimum road system needed for travel and the protection, management and use of NFS lands, and (2) identify roads that are no longer needed to meet forest management objectives, and therefore scheduled for decommissioning. NFS expects to identify an appropriately sized and environmentally sustainable road system that is responsive to ecological, economic, and social concerns, which will ~~include-reduce~~ water quality effects from forest runoff. NFS staff is expected to engage the public in the process, involving a broad spectrum of interested and effected citizens, other state and federal agencies, and tribal governments.

Recent Progress

State and private forest landowners have made a significant capital commitment to protecting public resources and listed species through the RMAP requirement, as detailed in the [2010 HCP Annual Report](#). As of December 2010, approximately 18,475 miles have been improved to current standards, and recent reports have estimated this to be a 70+% accomplishment rate. However, DNR does not have high confidence in this number due to variable reporting methods and therefore will be compiling additional RMAP implementation data in 2011-12 to be reported in future FPHCP annual reports. There are currently 262 approved RMAPs statewide. Between 2001 and 2010, over 3,700 fish passage barriers were removed or replaced, which is about 54 percent of known fish barriers identified in RMAPs. As a result, over 1,700 miles of fish habitat were opened in streams on forestlands. In addition, over 9,000 RMAP checklists have been submitted by small forest landowners associated with the approval of forest practice applications.

~~As of 2010, over 193 projects were completed and up to 500 miles of stream habitat previously inaccessible to fish were opened up through t~~The Family Forest Fish Passage Program (FFFPP). ~~has been successful at completing, as of 2010, 193 projects and opening up 500 miles of stream habitat previously inaccessible to fish.~~ Over that same time period, the state of Washington has invested approximately \$14 million in the program. For the 2011 construction season, 39 barriers are planned for correction, opening up 62 miles of habitat at a cost of approximately \$3.2 million. Due to reduced funding levels from \$5 million in FY 2009-2011 to \$2 million in FY 2011-2013 biennium, only nine projects are planned to be completed in the 2012 construction season.

According to the [FY 2010 Legacy Roads and Trails Accomplishment Report](#), \$7.3 million was spent on Washington State's federal forest roads and trails. With this funding, 42 miles of roads were decommissioned, and 788 miles of road storm proofing and maintenance were conducted. In addition, five fish passage barriers were restored, opening a total of 12.2 miles of fish habitat. This is the greatest commitment of legacy roads and trails funding for the Pacific Northwest region in more than a decade. Unfortunately, this level of effort is insufficient to address the backlog of NFS roads system repairs.

Given that more than 80 percent of the current NFS roads system was built before 1980, and there are over 90,000 miles of forest roads just in the Pacific Northwest region, it seems unlikely this restoration effort will meet its commitment with the State of Washington to implement all necessary road maintenance and abandonment by 2015. It was estimated in the 2000 MOA that Congress (at that time) allocated less than 20 percent of the funding necessary for the United States Forest Service (USFS) to adequately maintain their roads. More recent estimates in 2005 suggest a \$300 million backlog of work on forest roads in Washington alone. With 2010 marking the greatest commitment of funding in a decade, it appears that Congress will have to substantially increase funding in order to ensure road systems on federal lands do not contribute to poor water quality for salmon and people in the Puget Sound Basin or threaten downstream habitat improvements that have been made.

The effort to appropriately size the NFS road network has begun, with nine of seventeen National Forests in the Pacific Northwest region having begun the process of conducting a "Travel Analysis" to identify an appropriate road system.

Ongoing Programs

Large landowners must bring all roads into compliance with forest practices standards by October 31, 2016 (or with approved extension by 2021).

DNR will continue to assure that small forest landowner roads used for forest practices activities are brought up to forest practices standards as part of the checklist RMAP process. In addition, Forest Practices will continue to track RMAPs and checklist RMAPs submitted by small landowners, reporting progress in its annual published HCP report. DNR will report to the legislature in December 2013 on the progress of checklist RMAP implementation.

The FFFPP has more than 500 landowner-proposed repair projects that are not funded. Several hundred more barriers likely exist on these smaller forest ownerships, in addition to those already waiting for funding. However, this is not a complete inventory. Every year 50 to 100 new landowners enroll in the program. The major factor limiting progress is funding. More than 30 local community conservation organizations around the state provide project oversight and accountability, and work with the small forestland owners to ensure projects are identified and installed according to plan. Minimal state agencies staff provide the program structure, accounting, coordination and consistency. In terms of stream habitat opened up per dollar spent, FFFPP has proven to be one of the soundest investments in salmon recovery being made in Washington State.

When U.S. Forest Service received \$20 million of 2010 funding for the Legacy Roads and Trails program in the Pacific Northwest region, they planned three years of projects, assuming maintenance of that budget. In fiscal year 2011, however, that budget was reduced to \$8.5 million. The fiscal year 2012 budget is uncertain, but unlikely to result in greater program funding given federal budget shortfalls. In

short, a significantly more modest restoration effort can be expected in Washington State in 2011 and 2012.

All NFS units in the region are preparing plans for completion of the travel analysis by 2015. They will each identify a road network that can be reasonably maintained under current budget constraints, given management objectives, and responsive to ecological, economic and social concerns. In addition, each unit has been asked to identify the capital budget needed to bring that appropriately sized road network up to a level that can be maintained under the current budget. This will include road maintenance and abandonment needs, and fish passage issues needing correction. This capital budget needs assessment will provide an updated estimate of the true backlog of road maintenance needs on federal forestlands.

Near-Term Actions

C4.2 NTA 1: Risk Assessment of Small Forest Landowner Roads. DNR, in consultation with Ecology, will design and complete a resource risk assessment of small forest landowner roads for the delivery of sediment to waters of the state. Work with stakeholders to propose an approach to solving identified problems, and focus restoration efforts on small forest landowner lands in the Puget Sound Basin.

Performance measure: Design resource risk assessment and implementation plan by June 2014.

C4.2 NTA 2: Accelerate Family Forest Fish Passage Program Implementation. DNR, in collaboration with other agencies, will seek increased support for the Family Forest and Fish Passage Program (FFFPP) based on the resource risk assessment and prioritization and will clear the current backlog of FFFPP projects within the Puget Sound Basin. This should build on strong existing partnerships with federal agencies, such as USDA NRCS, US FWS, NOAA Fisheries, EPA, and Bonneville Power Administration, as well as outreach to private sector and nonprofit sector funding sources.

Performance measure: Additional funding secured by July 2013; Initiate cleaning of backlog and remove 75 fish passage barriers per year beginning July 2013.

C4.2 NTA 3: Fish Passage Barriers. WDFW will assess and prioritize fish passage barriers by watershed within the Puget Sound.

Performance measure: Number of watershed habitat assessments and prioritization analyses conducted.

C4.2 NTA 4: Enhance RMAP Database: DNR will continue to update the Large Landowner RMAP database to ensure tracking of progress in bringing roads up to current standards by 2016 (or 2021 with approved extension).

Performance measure: RMAP data base updated quarterly with reports from landowners.

C4.2 NTA 5: RMAP Coordination with Federal Partners. DNR will work to secure executive-level participation from U.S. Forest Service in annual RMAP coordination meetings with

landowners, WDFW, Ecology, affected tribes, NOAA-Fisheries, USFWS, affected counties, watershed councils and other interested parties within each watershed (per WAC 222-24-051(11)). Participants will discuss opportunities to provide a coordinated approach within each watershed resource inventory area by (1) prioritizing road maintenance and abandonment planning and (2) exchanging information on road maintenance and stream restoration projects.

Performance measure: By December 2013, DNR convenes 19 WRIA meetings annually and includes USFS in the meetings for WRIAs where USFS owns land.

Reduce Pressures on the Puget Sound Ecosystem from Wastewater

The Challenge

Pollution of the rivers, creeks, bays and open waters of Puget Sound comes from a variety of sources and travels along many pathways. This section focuses on the potential for pollution from wastewater collection, treatment, and disposal – the system that is designed to collect and treat used water and human waste from homes and businesses and, in some cases, wastewater from industrial processes and urban stormwater. Essentially, everything that goes down a sink or is flushed down a toilet ends up in the wastewater system. This includes not just human waste but also a wide range of household cleaning products and chemicals and personal care products.

Wastewater management involves a spectrum of approaches and technologies that can be used to effectively treat sewage in different situations. In every case, the selected approach and technology must be tailored to local site conditions and take into account such factors as development densities; capital, maintenance and operation costs; and protection of public health and water resources. Generally, wastewater is treated either through a wastewater treatment plant or through an on-site sewage system. Both types of systems are regulated and permitted by state and/or local agencies.

Wastewater treatment plants (WWTP) are centralized facilities that use sewer collection systems to serve densely developed areas; they typically discharge treated effluent to surface water. On-site sewage systems, commonly known as septic systems, are decentralized or distributed systems that serve small communities, areas of limited development, and individual properties. They are called on-site systems because they treat wastewater on or near the site where the wastewater is generated.

Both types of systems are part of the region's permanent wastewater infrastructure. There are roughly 100 WWTP that discharge to surface waters in the Puget Sound region. There are about 300 large on-site sewage systems (LOSS) and more than a half million small on-site sewage systems (OSS) in the Puget Sound basin. Wastewater treatment systems play a critical role protecting public health and water quality, but they need proper management, operation, and maintenance to ensure effective treatment and to protect the infrastructure investments.

Ten centralized Puget Sound facilities include combined sewer overflows (CSOs) as part of their sewage and stormwater system. CSOs often are located in older parts of cities. Sewage and stormwater flow through a single piping system to a sewage treatment plant. During heavy rainfall events the system can be overwhelmed and is then designed to "overflow" untreated wastewater and stormwater at specific outfalls. In some locations, these CSO outfalls have been associated with sediment contamination and other impacts. Untreated wastewater also is discharged to Puget Sound from some boats and vessels.

Strategies for reducing pressures on Puget Sound from wastewater include efforts to prevent and control pollution from on-site sewage systems, wastewater treatment plants, and boats and vessels. They also include consideration of overarching approaches to promote watershed-based and integrated approaches to better manage the region's wastewater treatment needs.

Climate Change

Reducing existing stresses on the ecosystem is an important part of climate change adaptation strategies. Strategies to reduce pressure from wastewater from OSS and treatment plants, helps implement the state climate response strategies to:

- Safeguard fish and wildlife and protect critical ecosystem services that support human and natural systems,
- Reduce the vulnerability of coastal communities, habitat, and species.

In addition, wastewater facilities can be vulnerable to climate change impacts. Extreme weather events could cause more frequent combined sewer overflow events and intrusion of seawater could damage equipment and strain. Higher water tables and increased flood events may increase corrosion of underground utilities. Siting of retrofits and new facilities will need careful consideration.

Relationship to Recovery Targets

The 2020 target for the management of OSS is to inventory all OSS, fix all failures, and be current with inspections at 95 percent of systems in marine recovery areas and other designated areas by 2020. The target also calls on local health jurisdictions to expand these areas and programs to cover 90 percent of Puget Sound's un-sewered marine shorelines by 2020. The strategies and actions are designed to help achieve the target.

Three other targets closely associated with the management of wastewater are (1) improved water quality and pollution controls to achieve a net increase of 10,800 harvestable shellfish acres; (2) ensuring human-related contributions of nitrogen do not result in more than 0.2 mg/l reductions in dissolved oxygen levels anywhere in Puget Sound by 2020; and (3) ensuring that all monitored Puget Sound beaches meet enterococcus (a pathogen associated with fecal matter) standards by 2020. Other pollution sources and management programs also directly influence progress toward these ecosystem recovery targets.

Local Priorities

Several local areas have priorities related to decentralized wastewater treatment.

Local Integrating Organization	Priorities
San Juan Islands	<p>Tier One</p> <ul style="list-style-type: none">• Implement best management practices to reduce pollution of source wastes by residential runoff and non-point sources.

Local Integrating Organization	Priorities
	<p>Tier Two</p> <ul style="list-style-type: none"> Ensure coordination between planning and health departments on issuance of septic permits.
Strait of Juan de Fuca	<p><i>From 19 Strategic Priorities</i></p> <ul style="list-style-type: none"> Clean Water District Plans (Sequim-Dungeness Bay & Eastern Jefferson County) - Implement Sequim-Dungeness Bay and East Jefferson County Clean Water Districts projects and programs, including TMDL implementation strategy and/or on-site sewage management programs
South Sound	<p><i>From Strategic Initiative: Rural/Agricultural Runoff</i></p> <ul style="list-style-type: none"> Improve Operations and Management of septic systems in all 4 counties (e.g., Henderson inlet program)
Hood Canal	<p><i>Summarized general priorities</i></p> <ul style="list-style-type: none"> Identify where in the Hood Canal watershed the highest risk onsite septic systems (OSS) are located and evaluate the risk of contribution of nitrogen from OSS to Hood Canal. (Hood Canal PIC program is part of this and other actions) Explore the current regulations related to wastewater and water quality and assess potential additional or modified local or state regulations. Research and register low cost, low maintenance, non-proprietary retrofit of existing OSS and new OSS that will reduce nitrogen by at least 80% Repair or upgrade of OSS that are determined to be highest risk. Continued involvement of county/state managers/planners in the Aquatic Rehabilitation TAC to develop recommended actions to address water quality in Hood Canal. In coordination with state agencies (WDFW, Parks, address the need for additional sanitary services at popular recreation sites around Hood Canal.
Whatcom	<p><i>From working priority list</i></p> <ul style="list-style-type: none"> Implement onsite sewage system operation and maintenance programs including continued inspections of OSS, community trainings, and low interest loan programs. Implement water quality improvement projects identified in approved Shellfish Protection District plans, including OSS operation and maintenance and agricultural BMP technical and financial assistance.

C5. Prevent, reduce, and/or eliminate pollution from decentralized wastewater treatment systems

On-site sewage systems are an essential and valuable part of Puget Sound's wastewater infrastructure. They provide a high level of treatment and great flexibility developing and using properties where construction of, or connection to, centralized sewer systems is not feasible or practical. They can be designed and configured to treat sewage in most settings. Small systems (peak design flows below 3,500

gallons per day) typically serve single family residences or combined flows from fewer than a dozen homes. The vast majority of these systems are very small. The typical design for a 3-4 bedroom home is 360-480 gallons per day, and because of water efficiency measures such as low flow showers and faucets, most of these systems operate at closer to 250 gallons per day. Large systems (peak design flows up to 100,000 gallons per day) can be engineered to treat flows from up to 370 residential connections.

Small on-site sewage systems traditionally consist of collection pipes, a septic tank, and a drainfield. In this design, the septic tank holds and separates wastewater into solid and liquid components to allow initial decomposition and treatment in an anaerobic (septic) environment. From the tank, the liquid effluent flows into the drainfield, which is generally a series of perforated pipes or molded chambers installed in suitable soil. The drainfield provides further treatment by allowing the effluent to be exposed to an oxygen-rich environment where bacteria and other microbes continue to treat contaminants. The drainfield removes and inactivates pathogens as the effluent filters through the soil layers before entering the groundwater.

There are other treatment technologies in use that are collectively referred to as “alternative systems.” These systems often use devices to enhance aerobic treatment and may use filters to screen solids and pumps to pressurize and distribute the septic tank effluent more evenly over the drainfield to promote better soil treatment. Large on-site sewage systems are often engineered to include additional or other types of treatment.

When on-site sewage systems don’t function properly they can pollute groundwater or, if there is a direct connection, nearby surface water. The pathogens and chemicals in sewage can make people sick, contaminate shellfish and other water resources, and disrupt ecosystem functions. Older on-site sewage systems and systems in sensitive areas often present higher risks. In addition, even properly operating systems can leach excess nutrients into Puget Sound; an issue that needs further study and action to address. Work is underway to better understand and document the sources, loadings, and impacts of nitrogen on Puget Sound and the appropriate steps to effectively address this emerging challenge.

There are many strategies for improving the region’s decentralized wastewater infrastructure. The key is life-cycle management and care of on-site sewage systems, making sure they are properly sited, designed, installed, operated and maintained. Overarching strategies include (1) implementing and funding effective state and local on-site sewage programs; 2) providing low-interest loans to help homeowners repair and replace failed and malfunctioning systems; 3) documenting problem areas and pollution impacts and developing appropriate wastewater treatment solutions; and 4) improving practices, partnerships, and professional services to effectively and efficiently manage and maintain on-site sewage systems.

C5.1 Effectively manage and control pollution from on-site sewage systems.

The Washington Department of Health (DOH) administers the state rule for OSS with peak design flows below 3,500 gallons per day (Chapter 246-272A WAC). This is the vast majority of all systems in Puget Sound. Local health jurisdictions adopt and implement this rule to regulate and permit OSS at the local level. Among other requirements, the rule sets standards for siting, designing, installing, operating and

maintaining OSS. Once systems are in use, OSS owners are responsible for operating, monitoring, and maintaining their systems to make sure they function properly.

Under the state rule, the 12 Puget Sound local health jurisdictions are required to develop and carry out comprehensive plans to help ensure that systems are properly managed, with emphasis on operation and maintenance (O&M) activities and geographic areas where OSS pose an increased public health risk. The local O&M programs are designed and implemented differently in each county and are applied strategically to different types of systems, sensitive areas, and other situations (e.g., time-of-sale inspections) on the basis of public health risk and other criteria.

As part of the planning process, local health jurisdictions also are required to designate and protect marine recovery areas (Chapter 70.118A RCW). Marine recovery areas (MRAs) must be designated when the local health officer determines that existing OSS are a significant factor contributing to concerns associated with the degradation of shellfish growing areas, marine waters listed by the Department of Ecology for low-dissolved oxygen levels or fecal coliform, or marine waters where nitrogen has been identified as a contaminant of concern. The focus in marine recovery areas is to: (1) find existing failing systems and ensure that system owners make necessary repairs, and; (2) find unknown systems and ensure that they are inspected and functioning properly, and repaired if necessary.

Ongoing Programs

The state and local OSS programs are designed to regulate the safe and appropriate use of OSS to effectively treat sewage and to protect public health and water quality. Ongoing implementation of these programs includes many activities and responsibilities. Some are unique to DOH, some are unique to the local health jurisdictions, and some are shared. The work includes the following DOH performance measures: (1) Reviewing and approving local rule changes and reviewing waivers to ensure ongoing consistency with the state rule; (2) reviewing and registering proprietary products, additives, and sewage tanks for use in the state; (3) regularly updating state standards and guidance documents for alternative technologies; (4) contracting with and distributing state funds to help implement the local OSS management plans and coordinating semi-annual performance reporting; and (5) adapting OSS management plan implementation and reporting to align with and make progress toward OSS performance measures adopted for GMAP and the Puget Sound Action Agenda.

All twelve Puget Sound counties have developed local management plans and submitted them to the Department of Health for approval, and nine counties have designated one or more marine recovery areas. Based on the number of OSS systems noted in an earlier section of more than 500,000 and an annual failure rate of 1 percent, the annual need should approach 5,000. Many system repairs or replacements are financed privately or by lending institutions. Additionally, Ecology oversees funding to LHJs, which is directed to owners to support repairs; LHJs issue permits for repairs/replacements to many owners who self-finance repair work. These amount to hundreds of annual improvements and personal investments.

The GMAP program identifies two measures for OSS. First the state tracks the number of on-site sewage system repairs or replacements funded by Ecology in Puget Sound counties. The target is 39 every 6 months. Ecology passes funding to local health jurisdictions that identify the systems for repair or replacement and oversee the work. Since 2007, performance has been at or above the target, and as of December 2010, 388 systems have been repaired or replaced by local health jurisdictions through

financial assistance from Ecology. Second, the state tracks the status of OSS inventoried, inspected, and fixed in marine recovery areas and other designated sensitive areas. The target, consistent with the Puget Sound recovery goal, is to inventory all OSS, fix all failures, and be current with inspections at 95 percent in marine recovery areas and other designated areas by 2020. The target also calls on local health jurisdictions to expand these areas and programs to cover 90 percent of Puget Sound's un-sewered marine shorelines by 2020.

Near-Term Actions

C5.1 NTA 1: Effectiveness of OSS Rule. DOH, in consultation with local health jurisdictions (LHJs) and other interests, will evaluate the effectiveness of the state OSS rule, identify potential changes, and outline recommendations to the State Board of Health by December 2013.

Performance measure: Project design completed by December 2012, draft results compiled by September 2013, and recommendations completed by December 2013.

C5.1 NTA 2: OSS Best Practices. DOH will work with LHJs to identify successes and best practices, develop common performance standards, and recommend approaches to improve this work by December 2014.

Performance measure: Project design completed by December 2012, draft analysis completed by March 2014, and final analysis completed by June 2014. OSS inspection levels at 60 percent by December 2014 in designated areas.

C5.1 NTA 3: OSS Nitrogen Treatment Technologies. DOH will evaluate public domain OSS treatment technologies for nitrogen reduction and develop standards and guidance for their use if testing results indicate the technologies are effective and reliable. The evaluation will be completed by December 2014 and work on standards and guidance, if needed, will begin after that.

Performance measure: OSS installed and testing initiated by August 2012, evaluation of OSS technologies completed by June 2014, and plans for standards and guidance by December 2014.

C5.1 NTA 4: Centralized Treatment Outside UGAs. Commerce, in partnership Ecology and DOH, will identify shoreline areas outside urban growth boundaries where residential densities are great enough that it may be appropriate to extend centralized wastewater collection systems and that are in close enough proximity to centralized treatment that extension of infrastructure may be feasible. The goal of this effort is completion of design of at a least one pilot project by 2014 and construction of a least one pilot project by 2016.

Performance measure: By June 2013, Commerce, in consultation with Ecology and DOH, will produce draft criteria to identify shoreline areas outside urban growth areas that may be appropriate to extend centralized wastewater collection systems. By Nov. 2013, areas meeting those criteria will be mapped and analyzed for suitability pilot projects. By

July, 2014 design for at least one pilot project will be completed. Construction for at least one pilot project will be completed by September 2016.

C5.1 SJ 4: San Juan County OSS Program. San Juan County Health and Community Services will fully implement the On-site Sewage System (OSS) Operation and Maintenance Program Plan.

Performance measure: 100% of systems in sensitive areas in compliance and current with inspections by 2014 and 60% of alternative systems county-wide to have inspections between 2010-2014.

C5.1 WS 7: West Sound OSS repairs. Kitsap Public Health will report on the number of OSS failures repaired using funds from the Craft3 septic loan program by December 2013.

Performance measure: Number of OSS failures repaired using funds from the Craft3 septic loan program by December 2013.

C5.2 Effectively manage and control pollution from large on-site sewage systems.

DOH directly regulates and permits large on-site sewage systems (LOSS) with flows between 3,500 and 100,000 gpd (chapter 246-272B WAC). DOH adopted a revised LOSS rule in 2011. Among other changes, the expanded LOSS program consolidates all LOSS permitting authority at DOH, requires annual operating permits for all LOSS, and requires protection of public health and the environment. The rule is structured to regulate and permit LOSS in different situations ranging from newly constructed LOSS to existing LOSS that have never been documented or permitted. The revised rule includes many new requirements and approaches for siting, designing, constructing, operating, maintaining, repairing, permitting and managing LOSS.

Ongoing Programs

The overarching performance objective of the LOSS program is to regulate the systems and owners to achieve effective long-term treatment and to protect public health and water quality. The program includes a strong focus on Puget Sound. The work includes the following DOH performance measures: (1) locate, assess, and permit all LOSS with emphasis on marine recovery areas and other designated areas; (2) annually review and renew operating permits; (3) issue permits for LOSS previously permitted by Ecology as the permits expire; (4) issue permits for LOSS previously permitted by local health jurisdictions as the permits transfer to DOH; (5) work with LOSS owners as needed to address deficiencies in order to achieve adequate treatment and compliance with the rule and permit conditions; (5) develop technical guidelines and standards for LOSS design and O&M, system evaluations, document submittals, and other program activities; and (6) reset and report on the LOSS performance measure for GMAP based on the new LOSS rule and database and make progress toward the targets.

The state GMAP performance measure for LOSS addresses compliance with requirements of the revised LOSS rule adopted by DOH in 2011. By the end of 2011, DOH had identified 277 LOSS in the Puget Sound region, 263 of which were under permit. Compliance levels may drop as the new rule takes effect and all LOSS came under the program, including many previously undocumented LOSS and LOSS formerly permitted by Ecology or local health jurisdictions that are transferring to DOH.

Near-Term Actions

C5.2 WS 6 West Sound Sewer Feasibility. Kitsap Public Health together with the municipality will conduct sewer infrastructure feasibility study for sewers in areas such as Ostrich and Phinney Bay by December 2013.

Performance measure: Sewer infrastructure feasibility study conducted by December 2013.

C5.3 Improve and expand funding for on-site sewage systems and local OSS programs.

Funding for proper operation and maintenance of on-site sewage systems and for replacement of failing systems is an ongoing challenge. The work is expensive; the cost of replacing a system can be as high as \$40,000.

Funding assistance currently is comprised of a variety of grant and loan programs, including a \$4.2 million state program administered by the Department of Ecology to help homeowners and small businesses in the 12 Puget Sound counties repair, replace, or improve their existing systems. (See discussion of performance objectives for ongoing OSS programs, above.) Since 2007, this program has funded replacement of 388 failing systems around Puget Sound. In addition, Craft3 (formerly Enterprise Cascadia) offers low interest loans to homeowners and businesses in Jefferson, Kitsap, Mason, and Clallam Counties to repair or replace on-site sewage systems. This program, funded in part through the Department of Ecology, uses public and private resources to help owners fix or replace malfunctioning systems. From 2007 through December 2010, 245 systems were improved using this mechanism.

Other Puget Sound counties have established their own low-interest loan programs, as well. While these programs have helped, eligibility for them can be constrained by the age and location of the system, the income level of the homeowner, and other criteria. Additional and more reliable sources of funding are needed to support local O & M programs and programs to repair or replace failing on-site sewage systems.

Near-Term Actions



C5.3 NTA 1: Regional OSS Homeowner Loan Program. DOH, Ecology, and PSP will help evaluate options and support proposals to fund a unified, self-sustaining, low-interest loan program in the Puget Sound region to help OSS owners repair and replace their systems by June 2014.

Performance measure: Project design completed by August 2012, draft analysis of issues and proposed actions completed by March 2014, and final analysis completed by June 2014.



C5.3 NTA 2: Regional OSS Program Funding Source. **DOH will evaluate approaches and mechanisms (e.g., a regional flush tax or sewer surcharge) to establish a regional funding source for local OSS management plans and programs by June 2014. DOH will evaluate approaches and mechanisms (e.g., a regional flush tax or sewer surcharge) to establish a regional funding source for local OSS programs by June 2014.**

Performance measure: Project design completed by August 2012, draft analysis of issues and proposed actions completed by March 2014, and final analysis completed by June 2014.

C5.3 NTA 3: Funding Mechanism for Local OSS Programs. DOH will work to authorize local boards of health to contract with county treasurers to collect fees via property tax statements to implement local OSS plans and programs by June 2012.

Performance measure: Bill introduced and legislation passed and signed by June 2012.

Emerging Issues and Future Opportunities

In addition to the specific ongoing program activities and near-term actions described above, there are a number of ideas for future work that might be considered to better address the Puget Sound region's wastewater treatment needs and further reduce pressures on the Puget Sound ecosystem. These ideas should be an ongoing part of the regional discussion about how to best address wastewater treatment needs in the Puget Sound basin, and may inform future funding decisions, programmatic priorities and guidance, and/or may become near-term actions in future Action Agenda cycles.

Many of these ideas have to do with exploring potential future funding to ensure local health jurisdictions can effectively oversee and administer programs for reliable operation, maintenance, repair and replacement for on-site systems. They include:

- Evaluate funding options to help local governments with projects involving OSS conversions to more centralized treatment and to decommission abandoned systems. Residences in older neighborhoods in some cities remain on OSS even though surrounding, newer neighborhoods are served by centralized wastewater treatment. It can be difficult to convert these neighborhoods to centralized treatment—often individual homeowners do not have adequate resources or incentives to work together to fund conversion, utilities have little incentive to convert older neighborhoods, and local governments do not have the resources to subsidize these efforts.
- Evaluate and discuss models and ways to engage private wastewater companies and public utilities in OSS management as pilot projects or in new working relationships.
- Explore approaches to expand funding options for LOSS.

Other ideas raise a range of issues related to targeting technical and financial assistance, considering cumulative impacts, and improving treatment technologies.

- Identify priority areas around Puget Sound needing focused technical and financial assistance to solve chronic sewage problems. Explore options to provide targeted technical and financial assistance to solve these problems.
- Revise the definition of OSS failure to account for cumulative impacts of multiple OSS. We need to address situations where the cumulative effect of pollution from OSS in a community has a significant effect on water quality, even though the individual systems do not meet the traditional definition of failure (i.e., sewage that surfaces or backs up into a structure). This may

be the case, for example, where it is clear that a certain neighborhood is creating water quality impacts but no individual OSS in that area is failing.

- Objectively evaluate impacts of OSS for pollutants of concern other than fecal coliform, like nitrogen and toxic chemicals, and update regulations and management plan guidance to address these findings.
- Work with OSS industry and others to develop new, affordable and reliable technologies that reduce nutrient and fecal coliform concentrations in OSS effluent.
- Work to develop cost effective ways to effectively separate urine from wastewater.
- Develop standards of practice for OSS O&M service providers in the Puget Sound region.
- Include assessment of cumulative impacts in planning and permitting for centralized and decentralized wastewater systems in comprehensive plans. Centralized wastewater management options largely flow from the location at which the wastewater is generated—inside or outside an urban growth area; served by centralized treatment or not. Options to reduce wastewater generation through re-use of gray water, and to re-use treated water through reclaimed water projects are implemented largely on an ad hoc basis. There may be opportunities to take a more holistic approach to wastewater planning and thereby to better and more efficiently provide needed treatment and use all water resources fully. This issue also is discussed in strategy A8 on freshwater availability. In the draft Action Agenda a series of near-term actions were proposed on this issue, and comments on the NTAs were mixed, and focused on the interaction between GMA requirements and wastewater treatment planning. These ideas should continue to be considered and, ideally, ripened for inclusion into the next Action Agenda.
- Integrate climate change considerations into siting and design of new facilities and retrofits.

Target View: On-Site Sewage System Management

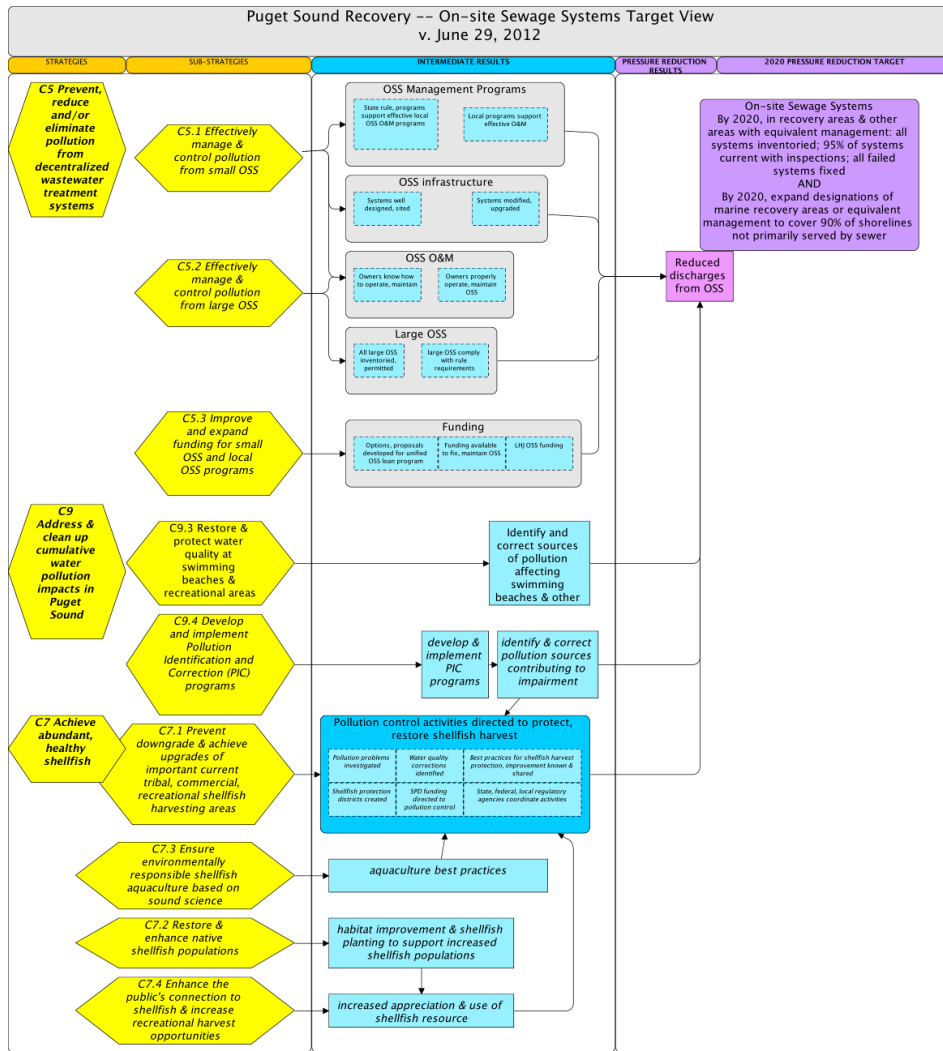
For many people, especially those in rural areas of Puget Sound, on-site sewage systems are the best option for sewage treatment. When properly designed and installed, these systems provide a high level of treatment. Proper care is the key to long-term performance of all sewage treatment systems. Older on-site systems and systems located in sensitive areas often present higher risks. With newer systems, advances in technology mean there is more need for regular maintenance to keep things working smoothly. Poorly maintained systems can break down, requiring costly repairs and polluting our prized waterways and water resources. Regular inspections help protect on-site sewage systems and Puget Sound.

The 2020 recovery target for on-site sewage system management has two components. The first is to inventory and fix all on-site sewage systems in marine recovery areas and other designated sensitive areas and to be current with inspections at 95 percent. The second part is to extend this work to cover 90 percent of Puget Sound's unsewered marine shorelines by 2020.

The Action Agenda strategies most related to achieving the recovery target for on-site sewer system management are:

- Effectively manage and control pollution from on-site sewage systems (C5.1)
- Effectively manage and control pollution from large on-site sewage systems (C5.2)
- Improve and expand funding for on-site system maintenance, repair and replacement (C5.3)
- Develop and implement local and tribal pollution identification and correction (PIC) programs (C9.4)
- Restore and protect water quality at swimming beaches and recreational areas (C9.3)
- [Ensure abundant, healthy shellfish for ecosystem health and for commercial, subsistence, and recreational harvest consistent with ecosystem protection \(C7.1, C7.2, C7.3, C7.4\)](#)

In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur and the target adopted for pressure reduction by 2020.



C6. Prevent, reduce, and/or eliminate pollution from centralized wastewater systems

Centralized wastewater treatment facilities are regulated through National Pollution Discharge Elimination System (NPDES) permits administered by EPA and Ecology under the federal Clean Water Act and state regulations. Untreated wastewater from municipal, industrial, and government facilities contains a broad spectrum of pollutants, including nutrients and pathogens. Wastewater treatment removes or transforms many, but not all, contaminants. Depending on the amounts and types of treatment, treated wastewater can contain a variety of contaminants, including personal care products, caffeine, endocrine-mimicking chemicals, pharmaceuticals, and industrial chemicals.

Approximately 100 municipal and industrial wastewater treatment plants discharge to the marine waters of Puget Sound and the Straits of Georgia and Juan de Fuca and to rivers and other water bodies in the Puget Sound watershed. The combined daily discharge of treated wastewater to Puget Sound is over 430 million gallons per day. In addition, during wet weather events, CSOs in some older urban areas of ten Puget Sound cities sometimes discharge mixed stormwater and untreated domestic and industrial wastewater when conveyance or treatment plant capacities are exceeded.

The effectiveness of pollutant removal at treatment plans varies with the treatment technology and to some degree the age of the treatment facility. Treatment effectiveness also depends on the amount and types of contaminants in the wastewater treatment facilities receive from residents and businesses. Municipal facilities have traditionally focused on removing pathogens, biochemical oxygen demand, toxic chemicals, and suspended solids with a primary objective of protecting human health. Industrial facilities typically have systems customized to the exact composition of their wastewater and/or discharge to municipal systems after pre-treatment on site. In Puget Sound most municipal wastewater treatment plants use secondary treatment technology, and few have needed to install advanced treatment technology to meet current discharge limits. All new facilities constructed in recent years have been built with advanced treatment.

Reducing the amount of impervious surface also may reduce the frequency and extent of CSOs and Inflow and Infiltration (I&I). Implementing the stormwater actions described in Section C2 will help reduce the pressure on Puget Sound from wastewater.

Relationship to Recovery Targets

The 2020 target most associated with centralized wastewater treatment is the larger Puget Sound nutrient target—that the combination of all human sources must not contribute to dissolved oxygen depletion more than 0.2 mg/L anywhere in Puget Sound. This is similar to state water quality standards. Potential human contributions to oxygen depletion in areas of Puget Sound include wastewater treatment plant discharges, on-site wastewater systems, stormwater, and other sources. The strategies and actions are designed to help achieve this target, as well as other targets closely associated with the management of wastewater: shellfish bed recovery; eelgrass recovery; swimming beaches; toxics in fish; and marine sediment quality. As with the dissolved oxygen target, other pollution sources and management programs also directly influence progress toward these ecosystem recovery targets.

Local Priorities

Several local integrating organizations identified wastewater treatment as a high priority strategy.

Local Integrating Organization	Priorities
Strait of Juan de Fuca	<i>From 19 Strategic Priorities</i> <ul style="list-style-type: none">• Carlsborg Wastewater Treatment and Water Reuse - Implement Carlsborg Urban Growth Area Wastewater Treatment and Water Reuse Strategy
South Puget Sound	<i>From Strategic Initiative: Urban Stormwater/Runoff</i> <ul style="list-style-type: none">• Complete upgrade at Wastewater Treatment Plants in South Sound (LOTT, Shelton, Solo Point, Chambers)
Hood Canal	<i>From General priorities</i> <ul style="list-style-type: none">• Building from experience with the Belfair wastewater treatment plant, implement existing plans to improve wastewater infrastructure in the Port Hadlock and Dosewallips areas.

C6.1 Reduce the concentrations of contaminant sources of pollution conveyed to wastewater treatment plants through education and appropriate regulations, including improving pre-treatment requirements.

Preventing sources of pollution conveyed to wastewater treatment plants will be a key part of reducing the overall threat to Puget Sound. Work in this area will rely heavily on strategies and actions related to reducing sources of toxics addressed in strategy C1 and include developing safer alternatives for chemicals in use, advancing programs to help prevent chemicals from entering the Puget Sound environment, education and technical assistance, and other strategies.

Pre-treatment programs, which are focused on working with businesses and industrial facilities that discharge wastewater to municipal treatment plants, also play an important role. These programs work to prevent the introduction of pollutants that could interfere with treatment plant processes, impact receiving water or biosolids quality, and/or threaten workers' safety. Effective implementation of the pre-treatment program plays a vital part in ensuring contaminants are not conveyed to wastewater treatment plants in amounts in excess of the plants' treatment capacity or acceptance requirements.

Emerging chemicals are a particular issue for pre-treatment standards, and are discussed in the emerging issues list, below. In addition, some commenters on the draft Action Agenda expressed concern that pre-treatment requirements, overall, are not protective enough for Puget Sound and should be reevaluated and updated, this is an issue that warrants further discussion.

Near-Term Actions

None; work will focus on implementation of ongoing programs.

C6.2 Reduce pollution loading to Puget Sound by preventing and reducing combined sewer overflows.

Combined sewer systems are wastewater collection systems designed to carry sanitary sewage (consisting of domestic, commercial, and industrial wastewater) and stormwater in a single piping system to a treatment facility. In periods of rainfall or snowmelt, total wastewater flows can exceed the capacity of the sewer collection systems and/or treatment facilities. When this occurs, the combined sewer system is designed to overflow directly to nearby streams, lakes, and harbors, discharging untreated sewage and stormwater. These overflows are called combined sewer overflows (CSOs) and can cause contribute to water and sediment quality problems.

Contaminants in CSOs can include pathogens, oxygen consuming pollutants, solids, nutrients, toxic chemicals, and floatable matter—all of which can harm the health of people, fish and wildlife. CSOs can contribute to shellfish harvesting restrictions, contaminated sediment, impairment of the aquatic habitat, and aesthetic degradation due to unsightly floating materials associated with raw sewage. Ten Puget Sound cities have combined sewage and storm collection systems.

CSO control is a vital part of the statewide effort to reduce and control stormwater discharges. CSO reduction programs are in place in 11 [cities-jurisdictions](#) in Washington. In 1988, Ecology estimated that the average volume of untreated CSOs discharged to the state waters was 3.3 billion gallons per year. Since then, Washington has made progress in addressing this pressure, with a reduction of CSOs to less than one billion gallons in 2009.

A number of communities have been successful in controlling and reducing their CSOs completely and the remaining communities continue to make progress in CSO control. Strategies for controlling CSOs include separation, storage, or treatment of flows. More recently, “green” stormwater infrastructure (GSI) has been used alone or in concert with other control strategies as a cost effective approach for some CSO reduction projects. Many different tools, including a variety of stormwater control strategies, could be used to reduce pressures on the Puget Sound ecosystem from CSOs.

One of EPA’s National Priorities for enforcement and compliance assurance for FY 2008–2010 addresses CSOs and sanitary sewer overflows (SSOs). The priority focuses on enforcement of the Clean Water Act and the codified CSO Control Policy which requires that CSO discharges to be reduced to a level that does not contribute to violations of the water quality standards.

Ecology requires that CSO discharges be controlled to an average of one discharge per year per outfall, consistent with the EPA’s CSO Control Policy. As of February 2011 the following Puget Sound CSO facilities have been determined to meet this standard: Anacortes, Bellingham, Bremerton, and LOTT (in Olympia). Other facilities are under permits or compliance orders to meet the standard: Everett (estimated compliance date 2017), King County (estimated compliance date 2030), Mount Vernon (estimated compliance date 2015), Port Angeles (estimated compliance date 2015), Seattle (estimated compliance date 2025), and Snohomish County (no estimated compliance date).

Ecology’s work on CSOs is focused on ensuring that facilities current in compliance so, and on providing technical assistance to facilities developing compliance plans and activities to ensure they meet their compliance dates.

Near-Term Actions

C6.2 NTA 1: Integrated Municipal Stormwater and Wastewater Plans. PSP, in collaboration with Ecology, will convene a group to make recommendations about use of integrated municipal stormwater and wastewater plans to meet Clean Water Act water quality objectives. This effort will recognize the use of integrated approaches as a way to prioritize allocation of resources to achieve the greatest environmental benefit, at the earliest time, consistent with meeting Clean Water Act obligations and applicable state laws, through appropriate sequencing of work.

Performance measure: By December 2012, conduct at least one initial meeting to scope work plan; By March 2013, a work Plan approved by key partners; By December 2013, recommendations for integrated stormwater and wastewater planning and implementation made to the Leadership Council. These dates are dependent on conclusions of current 2012 negotiations. If those negotiations are still in progress by September 2012, PSP will work with the Leadership Council to set new performance milestone dates.

C6.3 Implement priority upgrades of municipal and industrial wastewater facilities.

EPA has delegated authority to Ecology to administer the Clean Water Act provisions for NPDES permits. This includes both individual permits to discharge and general permits that cover multiple dischargers in particular categories of sources (e.g., municipal stormwater permits). All wastewater treatment plants that discharge to Puget Sound have individual NPDES permits, which are highly tailored to meet water quality standards for the pollutants in the discharge.

Ecology also is responsible for establishing Total Maximum Daily Loads (TMDLs) or water cleanup plans for impaired water bodies that are identified as not meeting state water quality standards. In marine waters such as Puget Sound, TMDLs require that contributions from the combined total of human point and nonpoint sources cannot cause dissolved oxygen levels to fall below particular concentrations; where concentrations naturally fall below these levels, the combined total of all human sources cannot cause more than a 0.2 mg/L depletion at any time. Marine waters with measured concentrations below the thresholds must be assessed to determine whether human activities are contributing to the low levels or whether the low levels result from natural conditions. Through implementation of the TMDL program, Ecology can identify when and where wastewater treatment discharge limits for individual treatment plans must be lowered to achieve water quality goals; these studies also will identify areas where nonpoint sources, including contamination from on-site sewage systems and polluted runoff, may need to be reduced.

Municipal and industrial wastewater treatment plants provide a critical element of Puget Sound protection by giving us a way to manage wastewater; however, outfall discharges into Puget Sound prevent harvest from shellfish growing areas on state-owned lands, depriving the state of badly needed revenue, half of which is used to restore and protect the state's aquatic lands through the Aquatic Lands Enhancement Grant program. Closures on private tidelands also reduce income for private shellfish businesses and deprive residents of the opportunity to harvest shellfish at recreational sites. Closures associated with outfalls are required regardless of permit discharge limits and regardless of permittees compliance with permits. These closures are automatic, based simply on the presence of the outfall and the associated potential for pollution. Many large outfalls are not practical to remove or relocate, but others may be under used, no longer needed, or able to be combined with other nearby outfalls.

Ongoing Programs

To support TMDL or similar processes in Puget Sound, Ecology is carrying out a number of studies to determine how nitrogen from a variety of sources affects dissolved oxygen levels in South Puget Sound and other areas with low levels of dissolved oxygen. These studies are a critical first step in determining what will be needed to improve water quality. The results of the studies may show that human-related sources of nitrogen need to be reduced to keep South Puget Sound and other regions healthy. If reductions are needed, the study will also help determine where reductions might need to occur and what actions might be needed, such as upgrading wastewater treatment plans to advanced treatment. These studies also will identify areas where nonpoint sources, include contamination from onsite systems and polluted runoff, need to be reduced. The TMDL program and related near-term actions are described in Section C9.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs; see C9 for additional discussion of TMDLs and water cleanup plans.

C6.4 Ensure all centralized wastewater treatment plants meet discharge permit limits through compliance monitoring, technical assistance, and enforcement where needed.

NPDES permit holders, including all WWTP that discharge to Puget Sound must report compliance in Daily Monitoring Records (DMRs) submitted to Ecology. Ecology reviews these DMRs and also inspects facilities for compliance.

Ecology's goal is that all WWTP maintain compliance with permits written to meet standards for all permit limits. Consistent with this goal, Ecology recognizes WWTP for perfect performance – that is, meeting every permit condition, every day, for an entire year. In 1995 only 14 plants in Washington State were in full compliance with permit requirements; in 2010, over 100 plants were in full compliance including 40 within the Puget Sound watershed.

When violations are found, Ecology's goal is to ensure plants return to compliance quickly. EPA guidance defines a major violation as any parameter violated by a permittee for the months in a row. In that case, Ecology's permit manager initiates contact with the permittee and takes a range of action to ensure a return to compliance. Ecology may issue enforcement orders if a permittee is unable to correct the violation. Ecology's goal is to inspect major plants once a year and minor plants every two years.

One issue that gained some attention during development of this Action Agenda update is inflow and infiltration. Excess water that flows into sewer pipes from groundwater and stormwater is called infiltration and inflow, or I/I. Groundwater (infiltration) can seep into sewer pipes through holes, cracks, joint failures, and faulty connections. Stormwater (inflow) can rapidly flow into sewers via roof drain downspouts, foundation drains, storm drain cross-connections, and through holes in manhole covers. Most I/I is caused by aging infrastructure that needs maintenance or replacement. There is some evidence that a substantial portion of excess water entering conveyance lines derives from side sewers that connect individual homes and businesses to the collection system. This excess water takes up capacity during peak flows that could otherwise be used for wastewater treatment alone and generates the need to build added capacity in pipelines, treatment plants, and other wastewater facilities.

Wastewater treatment providers manage inflow and infiltration as part of the overall maintenance of the conveyance system; however where I/I derives largely from side sewers or individual homes or businesses opportunities for centralized utilities to find and repair the sources of I/I can be limited, and present funding challenges. NPDES permits do not necessarily specify a target for the percent of water delivered to treatment plants that comes from I&I rather than through wastewater. Permittees are required to report I&I in their annual reports to Ecology. I&I levels are reviewed along with any permit violations or Sanitary Sewer Overflows (SSOs). SSOs are considered spills and must be reported to Ecology. Ecology may issue a compliance order to plants that have multiple problems, and I&I controls, if appropriate, could be one of several actions required. Currently one plant in South Puget Sound is under a compliance order. Recent permits added a new requirement that permittees pressure test force mains for exfiltration. Plants that have high levels of I&I in the winter may be more likely to produce exfiltration in the summer months, and some permits stipulate that any gravity sewers close to water bodies must pressure tested once per permit cycle.

Ongoing Programs

Key Ongoing Program Activities

- Ecology, in accordance with NPDES permits issued under the Clean Water Act, will continue to work with permittees to reduce SSOs in all areas of Puget Sound, with an emphasis on Marine Recovery Areas.
- Ecology will work with permittees to reduce inflow and infiltration in centralized wastewater collection systems in all areas of Puget Sound with an emphasis on watersheds with declining baseflows or watersheds closed to additional withdrawals or otherwise water stressed.
- Ecology will work with permittees to reduce exfiltration in all areas of Puget Sound with an emphasis on watersheds and marine waters where bacteria concentrations violate water quality standards.
- Ecology will complete evaluations of I/I project effectiveness in Puget Sound Basin and review evaluations from elsewhere to determine the potential effectiveness of I/I reduction programs.

Near-Term Actions

C6.4 NTA 1: **Water Quality Standards Update.** Ecology has initiated rule making to amend the Water Quality Standards to update and develop predictable regulatory compliance tools that address short and long-term source control programs. The proposed changes will provide predictable regulatory tools to help entities comply with existing and new source control requirements or discharge limits. The changes will allow compliance with requirements while they effectively work toward meeting permit limits and control sources of pollutants.

Performance measure: Rule Initiation: October 25, 2011; Rule Adopted: June 30, 2013.

C6.5 Promote appropriate reclaimed water projects to reduce pollutant loading to Puget Sound.

Reclaimed water is derived from domestic wastewater and small amounts of industrial process water or stormwater. The process of reclaiming water, sometimes called water recycling or water reuse, involves a highly engineered, multi-step treatment process that speeds up nature's restoration of water quality. The process provides a high-level of disinfection and reliability to assure that only water meeting stringent requirements leaves the treatment facility.

Reclaimed water can be used for a wide variety of beneficial uses such as irrigation, industrial process and cooling water, toilet flushing, dust control, construction activities, and many other non-potable uses. Reclaimed water also can be used as resource to create, restore, and enhance wetlands, recharge groundwater supplies, and increase the flows in rivers and streams. Reclaimed water is classified based on intended use. Class A reclaimed water must meet strict standards. Reclaimed water must not cause a violation of state water quality standards.

Ongoing Programs

Expansion of reclaimed water programs will be a vital part of Puget Sound recovery. In 2006 the Legislature directed Ecology to adopt a rule for reclaimed water use by 2010. Currently this rulemaking is delayed per the Governor's directive placing a moratorium on rulemaking; the earliest the rulemaking can be adopted under that moratorium is 2013. When final, the rule will provide a consistent, predictable, and efficient regulatory process. It also will encourage the generation and beneficial use of reclaimed water while preserving and protecting public health, the environment, and existing water rights.

Key Ongoing Program Activities

- Ecology will resume the Reclaimed Water Rule no earlier than 2013 or as directed by the Governor. The intent of this rule is to encourage the appropriate use of reclaimed water.
- Ecology will develop materials that describe the full range of beneficial uses for reclaimed water, best and appropriate uses, and public health issues (in consultation with DOH) to expand market demand for reclaimed water. The draft guidance document developed for the rule is on hold along with the Reclaimed Water Rule until 2013 at the earliest.

- As part of the future Reclaimed Water Rule, PSP and Ecology will develop a comprehensive outreach and education approach to promote the appropriate use of reclaimed water, including incentives for reclaimed water use where appropriate, and reduce barriers to reclaimed water projects.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

Emerging Issues and Future Opportunities

In addition to the specific ongoing program activities and near-term actions described above, there are a number of ideas for future work that might be undertaken to address the Puget Sound region's ongoing need for centralized wastewater treatment and to further reduce pressures on the Puget Sound ecosystem. These ideas should be an ongoing part of the regional discussion about how to best address wastewater treatment needs in the Puget Sound basin, and may inform future funding decisions, programmatic priorities and guidance, and/or may become near-term actions in future Action Agenda cycles. They include the following.

- Consideration of whether increasing nutrient removal requirements should be applied through the water quality based programs such as TMDL implementation, or whether Ecology should pursue a revision in secondary treatment technology standards for new treatment plants and upgrades at treatment plants that discharge to Puget Sound before all TMDLs are complete. Some stakeholders advocate requiring advanced secondary treatment (largely for nitrogen removal) and/or tertiary treatment (largely for additional chemical treatment or other forms of polishing) for all WWTPs that discharge to Puget Sound; others are concerned about making such a large investment (and thereby precluding other needed investments) without specific documentation that such treatment is needed to protect water quality.
- Better understanding and addressing other contaminants of concern. Due to new detection and sampling methods and new products and consumption patterns we are increasingly aware of chemicals that can threaten human and environmental health in effluents from wastewater treatment plants at very low concentrations. These include pharmaceuticals, personal care products, caffeine, natural hormones, and other chemicals. We should better understand where this is occurring and the impacts of these chemical in the environment and continue to refine source control and wastewater treatment, pre-treatment, and reclaimed water programs to address chemicals of concern.
- Replacement of aging infrastructure.
- Integrate climate change considerations into siting and design of new facilities and retrofits.

Improve Shellfish Health and Harvest

The Challenge

Shellfish play a significant role in the biological, cultural and historical context of Puget Sound. Healthy shellfish beds are essential to Puget Sound's ecosystem diversity and complexity. Pacific Northwest tribes have lived and harvested shellfish in Puget Sound for about 12,000 years, and archeologists have uncovered shell middens dating back as far as 5,000 years. Shellfish provide sustenance and figure prominently in tribal spiritual beliefs. In the 1850s tribal governments signed treaties with the US government relinquishing land but reserving rights to fish and harvest shellfish in usual and accustomed areas except for staked or cultivated shellfish beds.

Commercial shellfish harvesting began during the California Gold Rush era and continues today providing a significant source of jobs and economic activity in Puget Sound. Overall, Washington State leads the country in production of farmed clams, oysters and mussels with an annual value of over \$107 million. Across the state, shellfish growers directly and indirectly employ over 3,200 people and provide an estimated total economic contribution of \$270 million. In both Mason and Pacific counties, the commercial shellfish industry is the second largest private-sector employer, supporting more than 1,200 jobs and an estimated total annual payroll that exceeds \$27 million. In Puget Sound specifically, there are about 270 recreational shellfish beaches open to harvesting. WDFW conservatively estimates that \$125 shellfish harvesting trips are made each year to Puget Sound beaches, providing a net economic value of \$5.4 million to the region.

In addition to the cultural, recreational, and economic contributions shellfish make in Puget Sound, they also can play a role in improving the water quality of the Sound. Shellfish filtering can improve water clarity so sunlight penetrates the depths, which can improve eelgrass and macroalgae (attached seaweed) growth. Shellfish assimilate some of what they take in and pass on the rest as digested and undigested material that settles to the bottom sediments. These filtering and recycling processes can contribute to regulating the health of nearshore ecosystems and take on more importance as human activities and related pollution increase in shoreline areas. They also provide structure to the nearshore and refuge and forage opportunities and can help remove nitrogen from the water.

A significant number of shellfish beds are closed in Puget Sound due to pollution. The pollution is from a variety of sources, but mostly from fecal bacteria from humans, livestock, and pets that gets into the water and threatens the areas where oysters, clams and other bivalve shellfish grow. Work to improve water quality to enable the re-opening of shellfish beds closed because of pollution has been ongoing for many years and has achieved considerable success, especially since 1995. Nonetheless, expanding and promoting financial incentives and programs that protect, reopen, and enhance shellfish harvest areas and that restore and enhance the native Olympia Oyster and Pinto Abalone will contribute further to local and state economies.

The significant economic contribution of the shellfish industry was a major motivating factor behind the Washington State Shellfish Initiative announced on December 9, 2011. The initiative is a convergence of

the NOAA's National Shellfish Initiative and the state's interest in promoting a critical clean water industry. The NOAA policy establishes a framework to allow sustainable domestic aquaculture to contribute to the U.S. seafood supply, support coastal communities and important commercial and recreational fisheries, and help to restore species and habitat. NOAA sees aquaculture as a critical component to meeting increasing global demand for seafood and maintaining healthy ecosystems.

The Washington Shellfish Initiative is the first of its kind in the nation. While the initiative supports Governor Gregoire's goal of a "dig-able" Puget Sound by 2020, it also encompasses the extraordinary value of shellfish resources on the coast. As envisioned, the initiative will protect and enhance a resource that is important for jobs, industry, citizens and tribes.

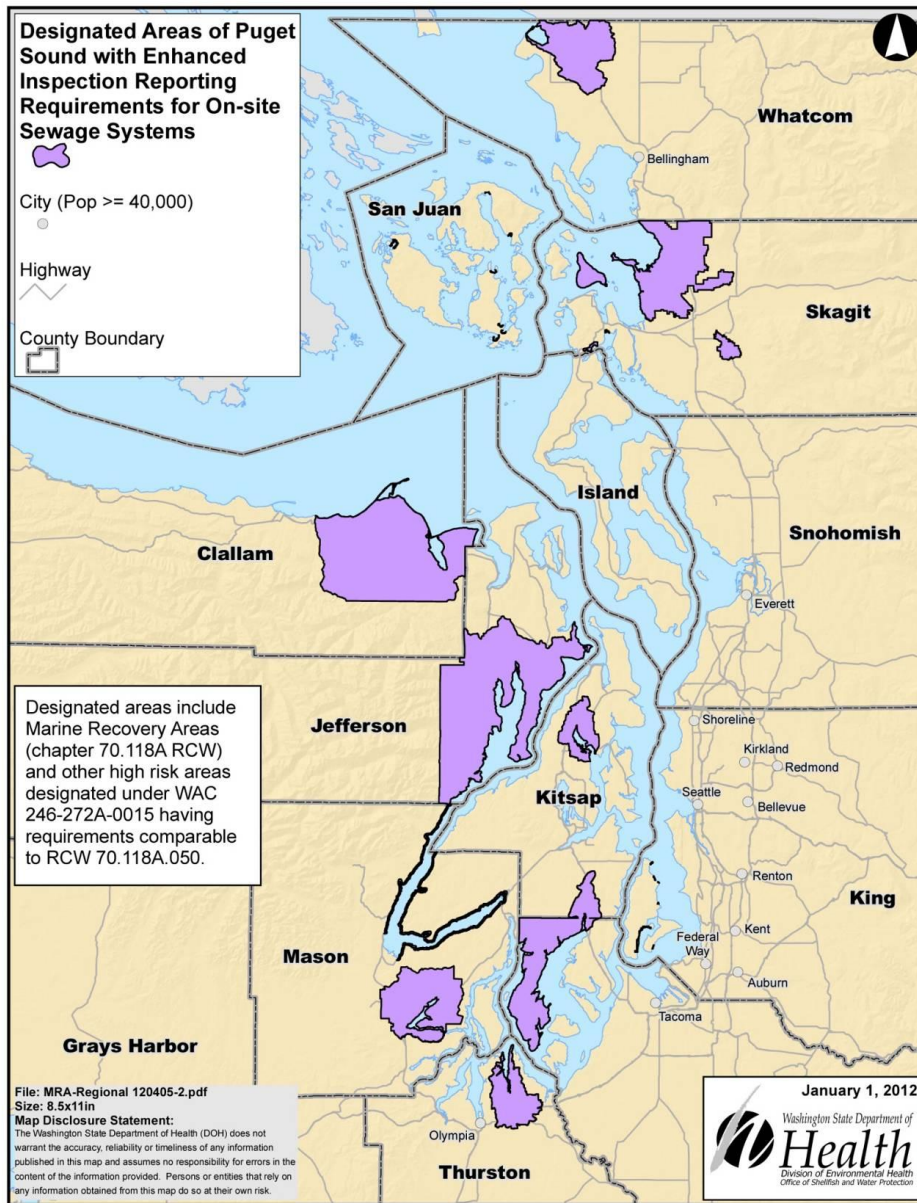
Climate Change

Increased acidity in marine waters from carbon dioxide emissions and upland runoff is threatening the aquaculture and shellfish industry. Ocean acidification is related to, but distinct from climate change, although they share a common cause, increasing carbon dioxide in the atmosphere. Ocean acidification is also a concern for harvest of wild shellfish and fish species that use marine plankton as a food source.

Adaptation strategies outlined in *Preparing for Climate Change: Washington State's Integrated Climate Response Strategy* (April 2012) include enhancing our understanding and monitoring of ocean acidification in Puget Sound and coastal waters, as well as our ability to adapt to and mitigate effects of seawater acidity on shellfish, other marine organisms, and marine ecosystems.

The Action Agenda includes support of a key action in the state response strategy: Supporting the work of newly created Blue Ribbon Panel on Ocean Acidification.

Strategies in this area focus on implementing the Washington Shellfish Initiative. The collective actions support working aquatic lands and improve water quality to protect and restore shellfish beds for human consumption. Additional strategies and actions that will contribute to the health and recovery of shellfish harvesting areas also are addressed in Sections on wastewater, stormwater, and toxics.



Relationship to Recovery Targets

The shellfish recovery target is of a net increase of 10,800 harvestable shellfish acres from 2007 to 2020 in Puget Sound, including at least 7,000 acres where harvest is currently prohibited. The strategies and actions in this section are essential for Reopening shellfish beds and avoiding closures. In addition, management of on-site sewage systems and freshwater quality will improve conditions for shellfish and help achieve the target.

Local Priorities

Several local areas prioritize shellfish bed restoration.

Local Integrating Organization	Priorities
South Puget Sound	<i>From Strategic Initiative: Rural/Agricultural Runoff</i> <ul style="list-style-type: none">Re-open Shellfish Beds (Henderson, Burley Lagoon, Minter, Oakland Bay, and North Bay)
West Puget Sound	<i>Summarized from Working Priority List</i> <ul style="list-style-type: none">Prioritize shellfish growing areas that are closed or have the potential to close, and initiate upgradesResolve issues identified in Washington Department of Health report: "2009 Shoreline Survey of the Dyes Inlet Shellfish Growing Area - Ostrich and Oyster Bays Addendum."Address bacterial contamination in freshwater streams that create closure zones at their mouths (e.g. Clear, Barker Creeks, Grover's Creek, Miller Bay)
Island Watershed	<i>From working list of possible priorities</i> <ul style="list-style-type: none">Implement shellfish protection plans within Island Watershed/County.
Stillaguamish and Snohomish Watersheds	<i>From working list of possible priorities</i> <ul style="list-style-type: none">Improve shellfish water quality and increase harvestable, upgraded shellfish acres in commercial production and use; coordinate, expand and promote financial incentives and programs for working aquatic lands that are protective of ecosystem health
Skagit	<i>From initial list of possible priorities</i> <ul style="list-style-type: none">Support the Skagit Clean Samish Initiative and continuing funding priority

C7. Ensure Abundant, healthy shellfish for ecosystem health and for commercial, subsistence, and recreational harvest consistent with ecosystem protection

C7.1 Improve water quality to prevent downgrade and achieve upgrades of important current tribal, commercial and recreational shellfish harvesting areas.

Protection and improvement of water quality and control of pollution will be critical to meeting the recovery target for shellfish harvesting areas for Puget Sound.

The Department of Health monitors shellfish harvesting areas and classifies them as safe or unsafe for harvest. As of the end of 2011 the Washington State Department of Health (DOH) managed the classification of 326,000 commercial shellfish harvesting acres throughout the state, approximately 190,000 in Puget Sound. There were 252,000 acres in 'Approved' classification, 12,000 acres 'Conditionally Approved,' 300 acres with 'Restricted' classifications, and 61,000 acres with 'Prohibited' classifications (see table below).

Department of Health shellfish harvesting area classifications, as of the end of 2011 (acres)

	APPROVED	CONDITIONALLY APPROVED	RESTRICTED	PROHIBITED	TOTAL
Washington State	252,000	12,000	300	61,000	326,000
Puget Sound					190,000

Note: figures may not add up to total due to rounding.

In 2011, DOH upgraded the classification of 697 acres in five commercial shellfish areas. Over the same time, 4,960 acres were downgraded in two areas. Poor water quality in the Samish Bay (Samish River) and Pacific coast growing areas resulted in significant classification downgrades.

Over the past 30 years, DOH has downgraded the classification of about 56,000 acres and upgraded the classification of about 46,000 acres (see table below). Most of the downgrades took place between 1981 and 1995, when 45,000 acres were downgraded and 7,000 acres were upgraded. Since 1995, Health has downgraded 11,000 acres while upgrading 40,000 acres. In Puget Sound, approximately 36,000 acres – or about 19 percent of commercial and recreational shellfish beds – are closed due to pollution sources.

Department of Health shellfish harvesting area classifications, 1981 – 2011 (acres)

	1981 - 1995	1995 - 2011	TOTAL: 1981 - 2011
Area Upgrades	7,000	40,000	46,000
Area Downgrades	45,000	11,000	56,000

Note: figures may not add up to total due to rounding.

The Department of Health also lists shellfish beds that are threatened with downgrade each year. In 2011 seven areas in Puget Sound were "threatened" with a downgrade in classification: Burley Lagoon, Dyes Inlet, Filucy Bay, Padilla Bay, Pickering Passage, Port Townsend Bay, and South Skagit Bay.

Even with significant downgrades in 2011, in recent years, through efforts of state and local government, tribes, private landowners, and shellfish growers, we have had a net increase of about 1400 acres of shellfish areas reopen for harvest due to pollution control. Strategies and actions in this area are focused on capitalizing on the lessons learned from these experiences and increasing this trend.

Ongoing Programs

The Department of Health is responsible for assuring that marine water is monitored and all potential

pollution sources are evaluated to ensure a safe shellfish harvest. To evaluate shellfish growing areas and protect public health, each year Health commonly collects over 10,000 marine water samples, evaluates about 125 miles of shoreline, and inspects numerous wastewater treatment plants and marinas.

Based on water quality and pollution source evaluations, Health identifies specific locations where shellfish harvest is “threatened” or “of concern” due to pollution. These areas meet the marine water quality standards; however, if pollution problems are not addressed, a downgrade is probable. Often these areas require special attention to prevent a downgrade.

Departments of Health, Ecology, Agriculture, the Partnership, the State Conservation Commission and conservation districts, Washington Sea Grant and WSU Extension, tribes, local health departments, shellfish growers and many other stakeholders work together to maintain and improve water quality to protect and restore shellfish areas. Local and tribal governments play significant roles in protecting and restoring water quality in shellfish harvesting areas. Pollution Identification and Correction Programs (PIC) are locally-driven processes focusing on specific geographic areas to find and fix nonpoint water pollution problems. PIC programs consist of a complete survey of all individual properties to identify nonpoint pollution sources, comprehensive education and outreach activities, technical assistance to homeowners, and financial incentives to encourage pollution control. These programs are widely considered one of the best approaches to protecting and reopening shellfish beds. PIC programs have been successful in reopening beds in Henderson Inlet in Thurston County, Oakland Bay in Mason County, and in several growing areas in Kitsap County where the PIC program is most developed. PIC programs are resource-intensive to accomplish all necessary aspects of the comprehensive program, but experience shows that this is necessary and effective in the long run. A major PIC effort is underway in Skagit County in Samish Bay to recover 4,000 acres of downgraded beds.

Current funding for PIC programs comes from local and tribal sources, and from state and federal grants. In 2011 and 2012 over \$3M in EPA funds will be dispersed to counties to develop sustainable PIC programs; stable long-term funding and support from local and tribal governments and citizens are also necessary for these programs to continue to protect and reopen important commercial and recreational shellfish harvest areas.

When shellfish growing areas are downgraded from nonpoint source pollution, counties are required to form Shellfish Protection Districts. In order to protect important shellfish resources, counties may also voluntarily form Shellfish Protection Districts. The purpose of Shellfish Protection Districts is to bring stakeholders together under a prescribed process to identify sources of pollution, develop a plan, and then implement that plan with accountability steps identified. The district may provide a funding mechanism for local and state resources to contribute to the implementation, but the district may also have a strong education and public involvement elements to change public behavior in such areas as OSS correction, improved agricultural practices, or stormwater control. In most cases, generation of funds is required to implement a Shellfish Protection District, and often districts incorporate PIC programs as part of the restoration process.

Near-Term Actions

C7.1 NTA 1: Shellfish Best Practices Library. DOH will work with the Partnership, Ecology, the Conservation Commission, and Conservation Districts and local governments to create a best practices library or menu highlighting successful locally-driven efforts to assist

in the development of shellfish protection districts, shellfish protection programs, and shellfish growing area restoration activities, such as the Henderson Inlet, Oakland Bay, and Samish Bay efforts.

Performance measure: By June 2013, complete survey of partners to identify practices used to identify and correct nonpoint pollution problems that impact shellfish growing areas (subject areas include on-site sewage systems, agricultural practices, stormwater, outreach and education monitoring). Develop best practices library by December 2013.

C7.1 NTA 2: Annual evaluation of shellfish restoration efforts. The Partnership will convene an annual meeting of the Departments of Health, Ecology, Agriculture, Conservation Commission, and EPA to evaluate restoration efforts in shellfish growing areas in Puget Sound and report the results to the region.

Performance measure: Net increase of 2,700 acres of harvestable shellfish beds, of which 1,750 should be from beds presently classified as prohibited.



C7.1 NTA 3: Pollution Control Action Team. Ecology, working with DOH, WSDA, EPA, and the Tribes will form a Pollution Control Action Team (PCAT) to respond quickly when areas are identified where water quality problems threaten shellfish areas ~~are identified~~. They will initiate community outreach and education, pollution identification, inspection, technical assistance to local agencies and landowners and finally, enforcement. The team will focus its work in priority areas and support PIC programs where they are established. The first effort will be in Drayton Harbor and Portage Bay.

Performance measure: Reduce fecal coliform loading in each priority area to upgrade the status of closed areas and prevent further degradation for those with a negative trend.

In addition, strategies and actions related to controlling pollution from runoff and wastewater described in C3, C4, C5 and C6, and to establishment of PIC programs in C9 are directly related to improving water quality and recovery of shellfish beds.

C7.2 Restore and enhance native shellfish populations.

Native shellfish restoration efforts will focus on two species: native Olympia oysters and pinto abalone.

The *Olympia oyster*, the Pacific Northwest coast's only native oyster, ranges from southeastern Alaska to Baja, California. For thousands of years, Olympia oysters provided sustenance for tribes and habitat for a host of marine organisms. Until the late 1800s, Olympia oysters were the most abundant bivalves in Puget Sound, where they occupied thousands of acres of productive, diverse habitat. Over-harvesting, sediment loads, and pollution drove the oyster to near extinction. Today, it occupies a fraction of its former range and is a Candidate Threatened Species in Washington State and a priority species for restoration.

Pinto abalone were once widely distributed throughout the waters of British Columbia and Washington state. In recent decades, populations have undergone sharp declines. Known for their large, muscular

foot and their pearlescent oval shell, pinto abalone are slow-growing, long-lived marine snails and are typically found in nearshore rocky habitats in semi-exposed or exposed coastal regions. More than 60 abalone species are found worldwide but the pinto, or northern, abalone is the only species found in Washington State, where they range from Admiralty Inlet to the San Juan Islands and the Strait of Juan de Fuca and are typically found at depths to about 20 m.

The Washington Department of Fish and Wildlife (WDFW) regularly monitors the abundance of pinto abalone at 10 index stations throughout the San Juan Archipelago. Data from surveys made in 2006 showed an overall mean abalone density of 0.04 m⁻², which is well below the minimum densities for successful reproduction.

Ongoing Programs

WDFW, NOAA, tribes and many other small and large local groups are involved in native shellfish restoration. Programs focused on Olympia Oyster restoration are oriented around the Native Oyster Rebuilding Plan, which will result in restoration of 19 historic large natural oyster beds and associated local ecosystems throughout Puget Sound by 2022. Abalone programs are focused on the work needed to ensure there is adequate abalone production capacity to support restoration. DNR is involved in native shellfish restoration efforts through the aquatic leasing program and the wildstock geoduck fishery management program.

Key Ongoing Program Activities

- The Washington Department of Fish and Wildlife, in collaboration with partners such as Puget Sound Restoration Fund, shellfish growers, the Northwest Straits Commission and The Nature Conservancy, and in collaboration with individual tideland owners, tribes, Marine Resources Committees of the NWSC, Health and other state and local partners, will revise, update, and continue to implement the Native Oyster Rebuilding Plan including accelerating restoration of the Olympia oyster.
- WDFW, PSRF, Washington Sea Grant, and university researchers, and SeaDoc Society in conjunction with others will use a 3-year NOAA grant to improve wild stock abalone hatchery methods and increase production of genetically diverse and disease free juveniles for out-planting. They also will seek additional funding to staff and expand abalone hatchery capacities and to develop remote nurseries and abalone food resources, thereby improving the opportunity to build local stocks to naturally reproducing levels.

Near-Term Actions

C7.2 WS 13: West Sound Shellfish Gardening. By April 2013, Kitsap Public Health, in partnership with the Puget Sound Restoration Fund, will expand a pilot shoreline owner shellfish gardening program to at least one additional site, as an outreach tool for water quality and shoreline issues. By December 2013, the program will be expanded to include two additional sites. Concurrently, Kitsap Public Health will report on the results and actions from PIC shoreline monitoring affecting shellfish growing areas, e.g. number of fecal sources identified and corrected.

Performance measure: Shellfish gardening pilot program expanded to one additional site by April 2013. By December, expand to two additional sites.

C7.3 Ensure environmentally responsible shellfish aquaculture based on sound science.

Intensive shellfish aquaculture can put pressure on Puget Sound and there are concerns that these activities may increase pollution, change the physical beach structure and substrate to the detriment of native species abundance and diversity, disrupt the food web, and affect other resource-based jobs such as fishing or crabbing. In particular, the effects of geoduck aquaculture on the benthic environment and fauna, food webs, water quality, and aesthetics are a concern. In 2007 the Washington Legislature passed HB 2220 to address these issues.

HB 2220 established a Shellfish Aquaculture Regulatory Committee (SARC) to advise the Department of Ecology on revisions to Chapter 173-26, Part III WAC (Shoreline Master Program Guidelines) regarding geoduck aquaculture. Effective March 2011, the Department of Ecology published provisions that require future local Shoreline Master Programs include an inventory of water quality data; known sediment contamination; existing shellfish cultivation areas and shellfish protection districts; and other data that inform the siting of aquaculture. These provisions also require local shoreline conditional use permits for new commercial geoduck aquaculture, provide guidance for permit content and administration, and ensure public and tribal notification of proposed geoduck aquaculture projects.

HB 2220 also directed Washington Sea Grant to review existing scientific information and commission scientific research, with SARC input, to examine key uncertainties related to geoduck aquaculture that have implications for the health of the Puget Sound ecosystem and the wild geoduck population. Ongoing studies include investigations of: the ecological and geochemical consequences of disturbances associated with geoduck aquaculture; cultured-wide interactions; and resilience of soft-sediment communities after geoduck harvest in Samish Bay.

In March 2010, the Washington State Legislature passed and the governor enacted a law on marine spatial planning in Puget Sound and along the Washington Coast requiring an interagency assessment and report on information related to marine spatial planning and recommendations. This report was completed in January 2011 and contains 21 recommendations related to implementing marine spatial planning in Washington, including Puget Sound. Implementation of marine spatial planning will give shellfish growers and upland owners greater certainty about where aquaculture will be permitted and further reduce the likelihood of conflicts related to aquaculture. Continuing work is needed to clarify the potential impacts of shellfish aquaculture and to help communities build consensus and collaboration on the role of shellfish aquaculture in Puget Sound.

Ongoing Programs

Key Ongoing Program Activities

- Washington Sea Grant and university researchers will complete the Geoduck Aquaculture Research Program and provide ongoing forums to share results and final reports of the three funded studies by December 2013.
- Pacific Coast Shellfish Growers Association, Pacific Shellfish Institute, World Wildlife Fund and the Food Alliance will promote and implement sustainable aquaculture standards and work with grower members to incorporate environmental codes of practice in members' sustainable aquaculture activities.

- Ecology will review any new aquaculture proposals for consistency with the Coastal Zone Management Act.

Near-Term Actions

C7.3 NTA 1: Aquaculture Shoreline Master Program Handbook. Ecology will publish an aquaculture Shoreline Master Program Handbook section with special emphasis on geoduck aquaculture and finfish net pen operations, update its aquaculture web resources to make them more comprehensive, and provide direct assistance and training to local governments on the aquaculture handbook. When the final findings of the Sea Grant geoduck aquaculture research are available, Ecology will review them and other appropriate, vetted sound science, to determine if amendments to WAC 173-26 are warranted.

Performance measure: Handbook complete or not; number of local governments reached through training and technical assistance.

C7.3 NTA 2: Areas Suitable for Future Shellfish Aquaculture. Ecology will coordinate with interested local governments, DNR, and stakeholders to support pre-planning and implementation of marine spatial planning and local shoreline master program updates by: gathering, compiling a ground-truthing baseline information on current aquaculture and filling data gaps and completing research to identify areas that are suitable and unsuitable for future shellfish aquaculture. Ecology will support marine spatial planning related to aquaculture by coordinating with interested local governments, DNR, and stakeholders on gathering, compiling and ground-truthing baseline information on current aquaculture and filling data gaps.

Performance measure: Mapping completed.



C7.3 NTA 3: Shellfish Model Permitting Program. **The Department of Ecology will work with the Governor's Office of Regulatory Assistance (ORA) to will** lead and facilitate a state team to develop and implement a Model Permitting Program that ensures early and continued coordination among state and federal agencies, tribes and local governments for permitting and licensing of shellfish aquaculture.

Performance measure: By June 2012, sign operation agreement; by September 2012, identify pilots; by November 2012, establish pilot project timelines.

C7.3 NTA 4: Nitrogen Control Pilots Using Shellfish. DNR will work with Ecology, the shellfish industry and researchers to create pilot projects testing the use of mussel culture or other suspended or beach culture to help address nitrogen pollution in sensitive areas, such as Quartermaster Harbor.

Performance measure: Two pilot projects initiated by January 2015.

C7.4 Enhance the public's connection to shellfish and increase recreational harvest opportunities.

When the public goes to Puget Sound beaches, they want to dig shellfish that are safe to eat and swim in safe waters. Annually, tourists and residents purchase 160,000 licenses to harvest shellfish from Washington waters, providing more than \$1 million in state revenues. WDFW estimates that the 125,000 shellfish harvesting trips made each year to Puget Sound beaches provide a net economic value of \$5.4 million to the region. It will be important to increase this connection to shellfish and to help people understand the connections between water quality and clean, healthy shellfish beds.

Near-Term Actions

C7.4 NTA 1: Shellfish Interpretive Programs and Events. By June 2014, State Parks, in collaboration with other public, tribal and private interests, will conduct shellfish interpretive programs and events to help forge personal connections between clean, productive Puget Sound waters, the shellfish we eat, and the iconic role shellfish occupy in Washington's cultural and culinary identity.

Performance measure: By December 2012, develop interpretive concepts and action plans with partners, and identify up to three pilot program locations. By October 2013, implement and evaluate pilot shellfish interpretive programs and events at selected State Parks. By June 2014, expand programs to additional Parks, incorporating evaluation results from pilot programs.

C7.4 NTA 2: Shellfish Messages, Events, and Materials. Washington Sea Grant will partner with state and federal agencies on a planning process to develop shellfish-related messages, publicize events, and develop materials.

Performance measure: By September 2012, planning process is convened. Additional measures will be set in the future.

C7.5 Answer key shellfish safety research questions and fill information gaps.

Some obstacles to expanding shellfish harvest opportunities are lack of knowledge to better estimate risk and delineate where and when shellfish are safe to eat. Actions under this sub-strategy will assist implementing agencies to better evaluate food safety issues related to shellfish and to make better decisions on shellfish area classification and status. Research to better define collateral environmental benefits of shellfish aquaculture (like nutrient removal) is also included in this sub-strategy.

Near-Term Actions

C7.5 NTA 1: Point Source Dilution Analyses Modeling. The Departments of Ecology and Health will work cooperatively under an existing EPA grant to evaluate use of Ecology environmental models for point source dilution analyses in Health's commercial shellfish area classification program.

Performance measure: Complete modeling study by June 2014.

- C7.5 NTA 2: Expand Biototoxin Monitoring. Expand biotoxin monitoring to address the marine toxin causing “Diarrhetic Shellfish Poisoning” (DSP). This involves including DSP into our Marine Biototoxin Monitoring Program. In addition, we must purchase and install special testing equipment to analyze shellfish extracts for this and other biotoxins. The instrument will also be used to develop alternate detection methods for Paralytic Shellfish Poisons (PSP) that eliminates the sacrifice of live test animals.

Performance measure: Purchase equipment and initiate monitoring by June 2012. Include DSP monitoring into the Marine Biototoxin Monitoring Program by June 2013.

- C7.5 NTA 3: Water Quality and Seasonal Harvest Restrictions. DOH, in cooperation with NOAA’s Northwest Fisheries Science Center, will conduct water quality studies of selected shellfish “wet storage” areas in Puget Sound to better correlate environmental conditions with potential causes of illness that seasonally restricts harvest.

Performance measure: Complete field studies to calibrate model by December 2013. Complete final model simulation report by June 2014.

- C7.5 NTA 4: Ocean Acidification Blue Ribbon Panel. Ecology, as part of the Washington Shellfish Initiative, will manage the Governor appointed Blue Ribbon Panel on Ocean Acidification to develop clear, actionable recommendations on understanding, monitoring, adapting, and mitigating ocean acidification in Puget Sound and Washington waters.

Performance measure: By March 2012, convene the panel; By October 2012, submit recommendations.

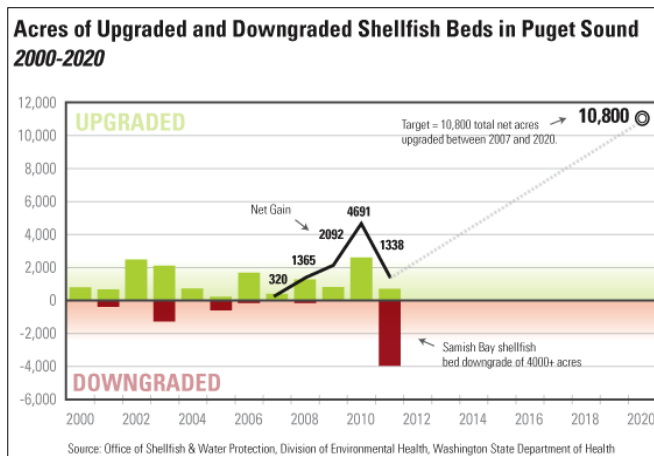
Emerging Issues and Future Opportunities

- Implementation of the Blue Ribbon Panel on Ocean Acidification recommendations.

Target View: Restoring Shellfish Beds in Puget Sound

Around Puget Sound, there are an estimated 190,000 acres of classified commercial and recreational shellfish beds. According to the State Department of Health, about 36,000 acres – approximately 19 percent – are closed due to pollution. The pollution is from a variety of sources, but mostly from fecal bacteria from humans, livestock and pets that gets into the water and threatens the areas where oysters, clams and other bivalve shellfish grow.

The 2020 recovery target for shellfish beds is a net increase of 10,800 acres of harvestable shellfish beds, of which 7,000 acres must be from beds presently classified as prohibited. The graph below illustrates recent data on the status of shellfish beds in Puget Sound, and relationship to the proposed target.



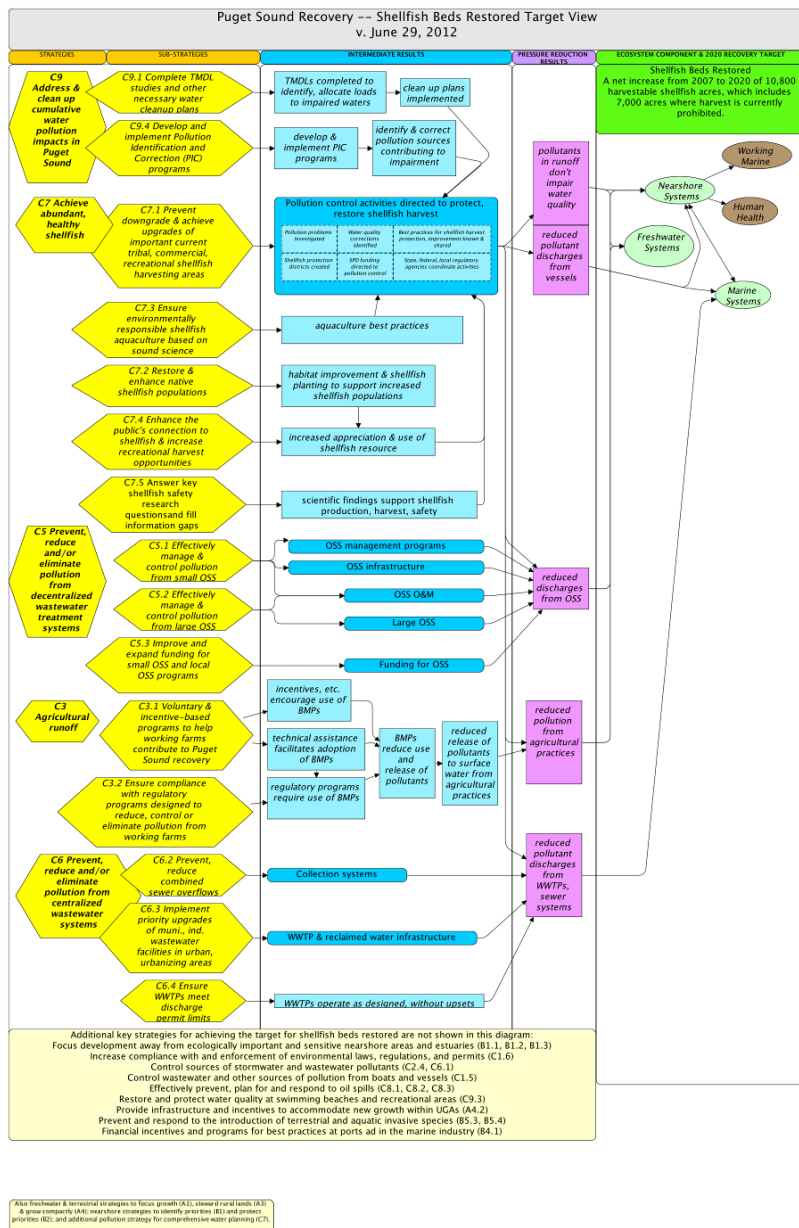
Green and red bars represent the annual upgraded and downgraded acres, respectively, while black line represents the net increase in harvestable acres of commercial and recreational shellfish beds in Puget Sound toward the 2020 goal of 10,800. Net increase is the upgraded acres in existing shellfish growing areas (or the restoration of unclassified acreage) to allow harvest, minus any downgrades in classification that prevent harvest. Downgrades of the shellfish beds are generally caused by fecal bacteria or other pollutants in the water that makes the shellfish unsafe to eat.

The Action Agenda strategies most related to achieving the shellfish bed recovery target are:

- Focus development away from ecologically important and sensitive nearshore areas and estuaries (B1.1, B1.2, B1.3)
- **Achieve-Ensure** abundant, healthy shellfish for ecosystem health and for commercial, subsistence, and recreational harvest consistent with ecosystem protection (C7.1, C7.2, C7.4, C7.5, C7.3)
- Address and clean up cumulative water pollution impacts in Puget Sound (C9.1, C9.4, C9.3)
- **Manage-Prevent, reduce, and control** agricultural runoff (C3.2, C3.1)
- Prevent, reduce and/or eliminate pollution from decentralized wastewater treatment systems (C5.1, C5.2, C5.3)

- Prevent, reduce and/or eliminate pollution from centralized wastewater treatment systems (C6.2, C6.3, C6.4, C6.1)
- Prevent problems from new development (C2.4)
- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.1, C1.6, C1.5)
- Effectively prevent, plan for and respond to oil spills (C8.1, C8.2, C8.3)
- Provide infrastructure and incentives to accommodate new and re-development within urban growth areas (A4.2)
- Prevent and respond to the introduction of terrestrial and aquatic invasive species (B56.54, B56.32)
- Use, coordinate, expand and promote financial incentives and programs for best practices at ports and in the marine industry that are protective of ecosystem health (B4.1)

In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.



Effectively Prevent, Plan for, and Respond to Oil Spills

The Challenge

Over 20 billion gallons of oil and hazardous chemicals are transported through Washington State each year by ship, barge, pipeline, rail, and road. Organizational failure, equipment failure, and human error can all lead to unintended and potentially disastrous consequences. Oil and chemical spills can threaten Puget Sound's productive and valuable ecosystems.

These incidents can kill fish, birds, and marine animals and contaminate beaches and shellfish. All spills whether on land or water can threaten public health, safety, the environment, and ultimately damage the state's economy and quality of life.

Climate Change

The risk of vessel incidents and oil spills could increase with climate change. Increased storm frequency and severity could increase the risk of vessel incidents and oil spills, as well as reduce the ability to respond quickly. Oil dispersion, movement on shore, and fate and effects could change as a result of changing ocean temperature and chemistry, as well as onshore conditions and habitats. Strengthened prevention and response readiness are part of adaptation needs.

Relationship to Recovery Targets

Prevention of major oil spills, which is a spill of 20 gallons or more, and ensuring a rapid effective response to any spills that do occur, contributes to achievement of virtually all the Puget Sound recovery targets. This is particularly important for achieving the target for Puget Sound resident Orcas. The National Oceanic and Atmospheric Administration (NOAA) listing document for the species identified major oil spills as the single greatest acute threat to their survival.

C8. Effectively prevent, plan for, and respond to oil spills

The 2009 Washington State Legislature (Legislature) directed the Puget Sound Partnership to provide independent advice and assessment of Washington State's oil spill programs and make recommendations for any necessary improvements. To that end, the Legislature recommended the appointment of a special advisory body with statewide representation. As a result, the Partnership's Leadership Council (Leadership Council) authorized the formation of the Cross Partnership Oil Spill Work Group (Work Group) in summer 2010.

Comment [KG11]: From Greg Hanon (western state petroleum association)

Rationale: "Page 154 of this draft action agenda details the Puget Sound Toxic Assessment conducted by The DOE (Publication No 11-03-055 and 11-03-024). The action agenda summarizes the assessment conclusions (in part) to include source control actions on copper, PAHs, bis(ethyl)phthalate, and petroleum."

The final report on Control of Toxic Chemicals in Puget Sound (Phase 3, publication 11-03-024) Page 162, defines major oil spills as greater than 20 gallons.

The recently released Supplemental Material for the Action Agenda Ranking Survey provides a description of moderate and large spills, and attempts to differentiate between spills of various hazardous materials, but this description has not been vetted or deliberated such as the definitions contained in the DOE report regarding toxic chemicals released to Puget Sound"

That broadly based stakeholder work group met for three full days during September and October 2010. At the conclusion of the third day, the group adopted four recommendations by consensus of the attending members. The Leadership Council passed Resolution 2010-04 on November 19, 2010 supporting the four work group recommendations.

Ongoing Programs

Engrossed Second Substitute House Bill 1186 (E2SHB 1186) was signed into law by Governor Gregoire in April 2011. Each of the four original work group recommendations was represented in the legislation and/or final state budget. In a letter to the, Director of the Washington State Department of Ecology (Ecology), Governor Gregoire requested that the state oil spill programs continue to work closely with PSP and the work group during rulemaking for HB 1186. As a result, the 2012-2013 Action Agenda includes strategies and actions to facilitate and track completion of two rulemakings.

In addition, the 2011 Washington State Legislature called for PSP and the Cross Partnership Work Group to continue their efforts to independently assess the state's oil spill programs during the 2011–2013 biennium. To that end, the work group met in May 2011 to establish the following consensus priorities for future work:

- Use of risk assessments to develop measures to reduce the risk of major oil spills
- Enhance transboundary coordination and marine safety in our shared waters with Canada
- Support the involvement of the state and local governments at tabletop oil spill drills

These priorities provide the foundation from which PSP, Ecology, and Washington Department of Fish and Wildlife (WDFW) developed the sub-strategies and near-term actions identified below.

Key Ongoing Program Activities

- Strengthen marine safety standards in our shared waters with Canada by consulting with industry, federal agencies, tribes and others.
- Report on deployments of the industry-funded emergency response tug at Neah Bay.
- Engage the Puget Sound Partnership's Oil Spill Work Group in the short-term work priorities described above.
- Continue U.S. Environmental Protection Agency's (EPA) and Ecology's Spill Prevention Control and Countermeasures Programs under the Clean Water Act.

Local Priorities

Local Integrating Organization	Priorities
San Juan Islands	<i>Tier 1 Strategies</i> <ul style="list-style-type: none">• Work with the Puget Sound Partnership on oil spill prevention and readiness programs within Puget Sound and with Canada.• Maintain local oil spill readiness and response programs in alignment with a regional readiness and response program.
Strait of Juan de Fuca	<i>Top Priorities</i> <ul style="list-style-type: none">• Oil Spill Prevention, Preparedness, and Response – Implement and

Local Integrating Organization	Priorities
	promote improvements in oil spill prevention, preparedness, and response programs, policies, or capabilities for the benefit of the Strait of Juan de Fuca and adjacent waters.
South Sound	<i>Strategic Initiative: Urban Stormwater/ Runoff</i> <ul style="list-style-type: none"> Oil spill response preparation and training
Whatcom	<i>Strategies in Development</i> <ul style="list-style-type: none"> Improve spill response capabilities in Lake Whatcom watershed and marinas and ports as identified.
Stillaguamish-Snohomish Watershed	<i>Strategies under Discussion</i> <ul style="list-style-type: none"> Implement the MRC's tiered recommendations for Snohomish County oil spill response and prevention By 2014 orchestrate local, state, and federal response to mitigate unintended damages from spill response related impacts to intertidal habitats (in the Port Susan MSA)

C8.1 Prevent and reduce the risk of oil spills.

While the rarity of major spills has not led to complacency, two decades of success in averting a low frequency/high impact incident in Washington waters ~~has led to diminished attention to systematic analyses of regional and industry sector specific patterns in oil spill risk by regulated industries and subsequent targeting of prevention efforts.~~ Ongoing changes in marine transportation patterns, including the substantial increase in crude oil exportation from Vancouver, BC, and the proposed Gateway Pacific Terminal at Cherry Point in northern Puget Sound, increase the risk of major spills to Washington's marine waters.

Comment [KG12]: Change from Greg Hanon (western state petroleum association)

"The cited language is conjecture, opinion, and has no supporting documents or substantiation."

Ecology's Spills Program 2009–2015 Strategic Plan for its oil spill program identifies "improving marine safety by emphasizing a risk-based approach" as one of its five strategic initiatives. The first recommendation in the joint report by Ecology and the Partnership on lessons learned from the 2011 National Commission on the Deepwater Horizon spill is to "complete a rigorous risk analysis on higher risk industry sectors to ensure that there is an appropriate level of investment reducing the risk of oil spills." The following near-term actions are necessary for Ecology and the broader spills community to fulfill legislation direction, accomplish Ecology's strategic plan and implement the Cross Partnership Oil Spill Work Group's recommendations.

Near-Term Actions

C8.1 NTA 1: **Traffic and Incident Trends.** Ecology will assess trends in ship traffic, vessel incidents and incident notifications for use in targeting inspections and setting standards.

Performance measure: Ecology presents concise report to the Cross PSP Oil Spill Work Group by July 2013.



C8.1 NTA 2: Evaluate Risk Assessments for Update Needs. Ecology will evaluate existing Puget Sound marine transportation oil spill risk assessments, identify any gaps in marine safety and work with experts to develop and apply appropriate risk reduction measures.

Performance measure: Gaps identified by Ecology, PSP, technical consultant and/or Cross Partnership Oil Spill Work Group.

C8.1 SJI 1: SJI Marine Manager Workshop. San Juan Marine Resources Committee will convene 20 agencies and non-governmental organizations responsible for oil spill prevention and readiness at the 2012 Marine Manager Workshop, including participation from the local, state, federal, and Canadian organizations. Workshop outcomes will include a list of agreed upon recommendations for oil spill prevention.

Performance measure: Local jurisdictions will consider adopting highest priority recommendations within their authority by 2014.

C8.2 Strengthen and integrate spill response readiness of the state, tribes, and local government.

In 2010 the Cross Partnership Oil Spill Work Group recommended the state's tabletop and worst case oil spill drills ~~participation~~ be restored to make the oil spill response system more robust. The Work Group recognized that the response system is enhanced when spill responders sharpen their technical skills and build trust in one another by practicing in drills together. Given the rarity of major spills requiring a Unified Command, and the recent reduction in the participation of state and local governments in drills due to budget cuts, some relationships and expertise has deteriorated over time. The following NTAs seek to strengthen those relationships and the effectiveness of actual response actions.

Ongoing Programs

Key Ongoing Program Activities

- Support an appropriate level of tabletop drill participation by Ecology and local government.
- Support the involvement of local government in Northwest Area Committee meetings and updates of the Area Contingency Plan.

Near-Term Actions

C8.2 STRT 2: Straits Spill Prevention, Preparedness, and Response. Implement and promote improvements in oil spill prevention, preparedness, and response programs and capabilities for the benefit of the Strait of Juan de Fuca and adjacent waters.

- a. Improve transboundary coordination on oil spills
- b. Establish Vessel of Opportunity Program in Neah Bay
- c. Expand oil spill drills along Strait of Juan de Fuca and Coast

Performance measure: In sequence: (a) Ensure 1+ CANUSPAC exercise is conducted and incorporates transboundary movement of personnel and/or equipment; (b) Vessel of Opportunity established in Neah Bay by July 2014 or referenced in contingency plans approved by April 2014; (c) Strait ERN participates in worst case or deployment drill planning process.

C8.3 Respond to spills and seek restoration using the best available science and technology.

The Cross Partnership Work Group's overarching recommendation was to improve the state's response capacity by requiring the regulated community to have timely access to the best achievable technology and training necessary to safely, promptly and properly respond to a worst-case oil spill. ~~This response capability must be independent of where or when the response is necessary.~~ The following NTAs support implementation of legislative direction under HB 1186, Ecology's rulemaking efforts, and strengthen coordination with Canada during transboundary spills.

The 2011 National Commission's Report on the Deepwater Horizon Spill generally recommended that restoration decisions be based on transparent, independent science and also provide compensation for poorly understood marine impacts. In addition, it recommended that long-term monitoring of affected resources take place for years following catastrophic spills. This NTA seeks to promote studies and initiatives that can be enlisted before, during or after a spill to better ensure that appropriate natural resource damage compensation is realized and public resources are properly restored.

Comment [KG13]: From Greg Hanon (western state petroleum association)

Rationale: "The section of the sentence does not make sense and is out of context with the remaining proposed near term action. What does it mean to have the response capability independent of where the response is necessary or when the response is necessary? The proposed sentence will cause confusion during implementation of the NTA. Removing the sentence clarifies the proposed NTA

Ongoing Programs

Key Ongoing Program Activity

- Implement Ecology's recommendations from the Pacific States/BC Oil Spill Task Force transboundary report.

Near-Term Actions

C8.3 NTA 1: WAC 173-182 Revision to Achieve Protection from Spills. Revise WAC 173-182 to conform with HB1186 from the 2011 session, requiring the best achievable protection from the impacts of oil spills.

Performance measure: Complete rulemaking by Dec 2012.

C8.3 NTA 2: Increase Natural Resource Damage Assessment Values. Revise WAC 173-183 to conform with HB1186 from the 2011 session, requiring Natural Resource Damage Assessment values be increased.

Performance measure: Complete rulemaking by Dec 2012.

C8.3 NTA 3: Identify Species and Locations at Risk in Spills. WDFW will establish planning efforts for coordinated, scientific collection of ephemeral data by local and regional entities for key species and locations at risk in oil spills to enhance response and NRDAR.

Performance measure: Number of ephemeral data plans developed for areas or facilities in high risk locations. Relevant training or preparation completed once the plan is in place.

C8.3 SJI 2: **Island Oil Spill Association Spill Readiness and Response.** Islands Oil Spill Association (IOSA) will maintain local oil spill readiness and response programs through 2014. Identify remaining local response needs at the 2012 Marine Managers Workshop and consider these, along with a funding and action plan, as part of the workshop recommendations.

Performance measure: To be determined.

Emerging Issues and Future Opportunities

The forthcoming Washington State *Integrated Climate Response Strategy* calls for revising oil spill geographic response plans to account for changes in shorelines, river conditions, and environmental conditions caused by climate change. These revisions should include geographic specific response strategies based on risk assessments and considerations of changes in infrastructure and logistical support.

Address and Clean Up Cumulative Water Pollution Impacts in Puget Sound

The Challenge

Water pollution in the marine waters and freshwater of Puget Sound comes from the introduction of toxic chemicals, pathogens, nutrients, and suspended sediments. These contaminants can harm aquatic life and pose health and safe problems in seafood, public water supplies, and beaches. There are many contaminated sites within and near Puget Sound that have resulted from past and ongoing releases of pollutants into the environment.

Water quality data indicate that the region's marine and fresh waters continue to have pollution challenges, but cleanup efforts have made some improvements.

- The Department of Ecology's Long Term Ambient Monitoring Program tracks water quality in 14 major rivers in Puget Sound using a Water Quality Index, which evaluates common pollutants such as temperature, bacteria, and dissolved oxygen, but not toxic pollutants. The Index shows that conventional water quality pollution has made small general improvements since 1995, but a majority of freshwater monitoring locations do not have good water quality (see chart).

Rivers Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Duckabush	93	95	94	90	74	94	89	85	88	96	86	89
Elwha	86	88	83	76	73	74	86	67	66	81	81	78
Skokomish	95	95	94	85	70	67	92	89	89	94	86	87
Snohomish	92	91	89	81	74	75	89	75	81	85	76	83
Borderline Rivers	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Cedar	87	76	60	78	72	84	81	79	79	81	77	78
Upper Skagit	87	86	59	85	64	81	84	75	75	81	56	76
Lower Skagit	89	91	71	76	61	73	77	77	75	76	74	76
Deschutes	62	72	70	73	61	83	88	88	83	76	74	75
Nisqually	40	60	79	79	69	71	74	75	91	74	83	72
Rivers Not Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
Green	82	73	66	67	75	49	72	68	60	69	63	68
Nooksack	65	68	58	57	52	54	61	51	60	69	56	59
Puyallup	60	58	57	55	51	58	59	58	61	49	62	57
Samish	86	75	32	49	34	71	67	74	59	80	63	63
Stillaguamish	81	60	44	72	55	67	71	69	75	75	71	67

Note: The Water Quality Index (WQI) is an aggregation of monthly measurements of typical water pollutants reported on a scale of 1 to 100. A higher number indicates better quality. An index score of 80 or above indicates that water quality is generally meeting our goals; between 70 and 80 is considered "fair" or "borderline;" 40-70 is failing to meet water quality goals and less than 40 is "poor."

Source: River and Stream Ambient Monitoring Program, Washington State Department of Ecology

Figure 1: Annual Water Quality Index (WQI) Scores at Freshwater Monitoring Locations, 2000–2010

- Ecology's 2008 water quality assessment identifies 501 different rivers and streams in the Puget Sound basin that require clean up plans (TMDLs). Some waterbodies have multiple segments listed and many segments are listed for more than one pollutant. Ecology's 2008 list included a total of 1,272 Puget Sound river and stream impairments (individual segment and parameter combinations). Bacteria (398 listings), dissolved oxygen (392), and temperature (341) are the most frequently occurring impairments of Puget Sound rivers and streams. Impairments occur in rivers and streams each of the 19 water resource inventory areas (WRIAs) in the Puget Sound basin. More than 60 percent of the total number of listings for Puget Sound rivers and streams are in five watersheds: Nooksack (238 listings), Kitsap (160), Cedar/Sammamish (154), Duwamish-Green (131), and Lower Skagit-Samish (113).
- Ecology's 2008 water quality assessment identifies an additional 129 impairments to Puget Sound lakes. Approximately one-half of these listings relate to toxic chemical contamination. These 67 toxics-related impairments of lakes combined with 24 toxics-related listings for Puget Sound rivers and streams indicate that toxic chemicals are the fourth most common type of impairment in Puget Sound freshwaters.
- Almost half of routinely monitored beaches in Puget Sound (50–70 beaches) consistently met water quality standards every year from 2004–2010, and another third met standards every year except for one or two years. Pollution sources have been addressed at several beaches since 2004, and two permanent beach closures were lifted in Island County in 2008. Despite these efforts, problems remain. In 2010, 26 percent of monitored beaches in Puget Sound failed to meet water quality standards and thus were unsafe for swimming.
- Ecology has been working to clean up 1,580 toxic-contaminated sites located within a half-mile of Puget Sound, including 150 contaminated sediment sites. As of December 2011, 664 of these sites have been cleaned up or reported as cleaned up by Ecology, potentially responsible parties, and other entities.
- In urban bays and harbors in Puget Sound, marine sediment quality data indicate mixed trends over time. Ecology's Urban Waters Initiative represents a major effort to reduce toxics entering urban bays and prevent re-contamination of sediments at cleanup sites including Elliott Bay and the Lower Duwamish in Seattle and Commencement Bay in Tacoma. Marine Sediment Chemistry Index (SCI) scores have improved in Elliott Bay and Commencement Bay, but declined in Bellingham Bay and Bainbridge Basin from 1997–99 to 2007–10. The recent SCI scores for the Bainbridge Basin and Bellingham Bay just meet the target score of 93.3, but the scores for Elliott Bay and Commencement Bay are still below the target score.²⁰ The SCI score for Bellingham Bay does not reflect sediment cleanup efforts that commenced after this sampling was conducted.

Climate Change

Reducing existing stresses on the ecosystem is an important part of climate change adaptation strategies. Strategies to reduce pressure from cumulative water pollution, helps implement the state climate response strategies to:

- Safeguard fish and wildlife and protect critical ecosystem services that support human and natural systems,
- Reduce the vulnerability of coastal communities, habitat, and species

²⁰ Ecology's Marine Sediment Monitoring Program data, as reported in the Puget Sound Partnership's target setting brief sheet (March 23, 2011), www.mypugetsound.net/directory-listings/documents/doc_download/83-toxics-in-sediments-target-setting-briefsheet-3-23-11-final.html.

Future sea level rise will need to be considered in the prioritization, design, and post-project maintenance of clean-up sites near the shoreline.

This strategy is focused on efforts to correct water quality and sediment quality problems related to toxic chemicals, nutrients, and pathogens by diagnostic studies and targeted cleanup activities. Implementing corrective actions to clean up impaired marine and fresh waters is essential for reducing the harm from pollution in the Puget Sound ecosystem. Sub-strategies in this section include completing total maximum daily load (TMDL) studies that serve as water column cleanup plans for water bodies, completing Cleanup Action Plans to restore and clean up contaminated upland and sediment sites within and near Puget Sound, addressing water quality issues at swimming beaches and recreational areas, implementing local pollution identification and correction programs, and developing a long-term effectiveness monitoring program for water quality improvement efforts.

Many of the sub-strategies presented here are important components of programs to address water quality problems that might be caused by pollution from urban runoff, wastewater discharge, and agricultural and forest runoff. Other strategies in priority C deal with efforts to reduce the release of chemicals to the environment and to control pathways by which pollutants are delivered to Puget Sound waters.

Relationship to Recovery Targets

2020 targets related to dissolved oxygen reductions of more than 0.2 mg/L, all monitored Puget Sound beaches meet marine water quality standards for bacteria, all Puget Sound regions and bays show minimal impact from toxic chemicals in sediment, and decreases in the number of impaired waters in Puget Sound freshwaters depend, in part, on clean up strategies and actions. These strategies also help achieve targets for shellfish beds restored, toxics in fish, water insects in freshwater, eelgrass, herring, and orcas.

Local Priorities

Several local areas identified priorities related to clean up.

Local Integrating Organization	Priorities
South Central	<i>Top Priorities</i> <ul style="list-style-type: none">Restore and protect Local Toxics Control Account funding under the Model Toxics Control Account (MTCA) for local toxics cleanup activities.
Strait of Juan de Fuca	<i>From 19 Strategic Priorities</i> <ul style="list-style-type: none">Clean Water District Plans (Sequim-Dungeness Bay & Eastern Jefferson County) - Implement Sequim-Dungeness Bay and East Jefferson County Clean Water Districts projects and programs, including TMDL implementation strategy and/or on-site sewage management programsLandfill Assessments, Closure, and Remediation - Assess, close, and remediate, where necessary, solid waste landfills within the Strait of

Local Integrating Organization	Priorities
	Juan de Fuca Action Area <ul style="list-style-type: none"> Port Angeles Harbor Ecosystem Recovery - Clean up and restore Port Angeles Harbor and waterfront
South Puget Sound	<i>From Strategic Initiative: Urban Stormwater/ Runoff</i> <ul style="list-style-type: none"> Urban Total Maximum Daily Loads (TMDLs) Complete and Implement Deschutes TMDL Implement Oakland Bay TMDL <i>From Strategic Initiative: Rural/Agricultural Runoff</i> <ul style="list-style-type: none"> Implement South Puget Sound Dissolved Oxygen Study Totten/Skookum TMDL <i>From Strategic Initiative: Salmon Recovery/Habitat Restoration</i> <ul style="list-style-type: none"> Clean up Budd Inlet Industrial Pollution
Hood Canal	<i>Top Priority</i> <ul style="list-style-type: none"> Phase I of a regional Hood Canal Pollution Identification and Correction program is in progress to determine the needs for a comprehensive regional program. <i>Examples from general priorities</i> <ul style="list-style-type: none"> Improve planning for and services of/between rural communities; Improve financial and technical assistance programs aimed at fostering voluntary stewardship and improving re/development standards
West Puget Sound	<i>From working priority list</i> <ul style="list-style-type: none"> Expand PIC programs in Kitsap & Pierce Counties Utilize PIC methodology for addressing sewage from failing septic systems to improve water quality and protect public health
Whatcom	<i>From working priority list</i> <ul style="list-style-type: none"> Implement Nooksack River TMDL

C9. Address and clean up cumulative water pollution impacts in Puget Sound

C9.1 Complete Total Maximum Daily Load (TMDL) studies and other necessary water cleanup plans for Puget Sound to set pollution discharge limits and determine response strategies to address water quality impairments.

In Washington State, the Department of Ecology administers the water quality improvement program known as the Total Maximum Daily Load (TMDL) process under Section 303(d) of the Clean Water Act. TMDLs establish limits on pollutants that can be discharged to water bodies. For impaired waters, TMDLs serve as water cleanup plans, articulating the sources of pollution, how much pollution needs to be reduced to meet water quality standards, pollution-reduction targets, and strategies to control the pollution. The TMDL process is the primary regulatory program that EPA and Ecology use to protect and

restore water bodies from the cumulative impacts of multiple sources of pollution, including point and non-point sources.

Common water quality parameters evaluated in TMDLs include dissolved oxygen and the nutrients responsible for reducing available oxygen, suspended solids, temperature, metals, pesticides, and other toxic chemicals and pollutants, all of which can harm aquatic organisms and their habitat. One of the important cumulative effects of pollution from multiple sources is reductions in the availability of oxygen in the water, known as dissolved oxygen. When an excess amount of nitrogen, phosphorus, and/or other nutrients enters a water body, it can result in a condition of depleted oxygen levels known as hypoxia that causes stress to the environment depending on the severity and duration of the event. In Puget Sound, there are chronic hypoxia zones including areas of Hood Canal, Budd Inlet, and Sequim Bay.

This sub-strategy helps ensure that Puget Sound marine and fresh waters support aquatic life and provide for other beneficial uses by ensuring that Ecology implements its responsibilities to develop and implement TMDLs so that pollution sources are identified and corrective actions are taken to address problems. These efforts to implement water cleanup plans to improve water quality in specific water bodies through the TMDL process complement the source-specific strategies discussed elsewhere in the Action Agenda. In particular, strategies to control the sources and pathways that excess nutrients and toxic chemicals enter Puget Sound include toxics source reduction (C1), stormwater runoff (C2), agricultural runoff (C3), and wastewater (C5 and C6) strategies. These strategies outline particular requirements, best management practices, assistance, enforcement, and education efforts to reduce sources of toxic pollutants, pathogens, nutrients, and other contributors to water quality issues in Puget Sound and its watersheds.

Ongoing Programs

Ecology and EPA's water quality programs are key ongoing programs that advance this sub-strategy to address water quality impairments in Puget Sound. These include the programs to develop and implement TMDL studies for dissolved oxygen, temperature, suspended solids, and other water quality contaminants; state and federal water quality financial assistance programs; and state and local non-point source control programs. Puget Sound-specific funding to advance this sub-strategy may be available from the Pathogens Lead Organization grant award from EPA to DOH and Ecology and the Toxics and Nutrients Lead Organization grant award from EPA to Ecology.

Overall, there is a backlog of TMDLs needing to be completed, and Ecology is also in the process of prioritizing future TMDL studies and implementation plans. Ecology's ongoing TMDL development and implementation activities in Puget Sound include the following:

TMDL Development (Continuing work to complete a TMDL)

- Bacteria TMDLs for Sinclair-Dyes Inlets and Liberty Bay
- Dissolved Oxygen TMDL for Clark's Creek
- Temperature TMDLs for Cranberry, Johns, Mill, and Soos Creeks
- pH TMDL for White River
- Multi-parameter TMDL for Deschutes River/Budd Inlet

TMDL Implementation (Ongoing staff support for implementation plan activities for a completed TMDL)

- Bacteria TMDLs for Henderson Inlet Watershed, Puyallup River, Skokomish River, Nisqually/McAllister Creek, Oakland Bay, South Prairie Creek, Lower Skagit River Watershed, Samish Basin, Union River, North Creek, Swamp Creek, Piper's Creek, Issaquah Creek Basin, Little Bear Creek, and Fauntleroy Creek
- Temperature TMDLs for Upper White River, Skagit River, Snoqualmie River, Green River, and Newaukum Creek
- ~~Ammonia TMDL for Duwamish and Lower Green Rivers~~
- Phosphorus TMDLs for Campbell and Erie Lakes, Lake Sammamish, Lake Ballinger, Cottage Lake, Lake Sawyer, and Fenwick Lake
- Water bodies with multiple TMDLs:
 - Bacteria and temperature TMDLs for tributaries to Totten, Eld, and Skookum Inlets
 - Multi-parameter and temperature TMDLs for Stillaguamish River
 - Multi-parameter and bacteria TMDLs for Snoqualmie River
 - Biological oxygen demand and ammonia TMDLs for Snohomish River estuary and bacteria TMDL for Snohomish River tributaries
- Bacteria, dissolved oxygen, and temperature TMDLs for the Bear-Evans watershed

Other Studies

- South Puget Sound Dissolved Oxygen Study (The results from the study will determine if a TMDL, or other action, is needed.)
- Quartermaster Harbor Dissolved Oxygen Study (Ecology is evaluating available data and modeling to determine whether a TMDL is needed to address the dissolved oxygen impairment.)

Key Ongoing Program Activities

- Ecology will continue ongoing work to complete TMDL assessments for high-priority water bodies in Puget Sound watersheds. Ecology also will continue to support implementation plan activities for completed TMDLs for Puget Sound and adjacent watersheds.
- Ecology will complete the South Sound Dissolved Oxygen Study by August 2012. If the study shows that something needs to be done to protect dissolved oxygen levels in South Puget Sound, Ecology will initiate a plan to improve water quality. Ecology will complete the Puget Sound Dissolved Oxygen Model in 2012, which will identify any other areas of concern in Puget Sound.
- Ecology will accelerate other ongoing efforts, including prioritizing watersheds needing TMDLs, to identify areas where enhanced wastewater treatment may be needed. In Puget Sound, results from TMDLs and water cleanup plans for Budd Inlet/Deschutes River will be available in 2013.
- The Hood Canal Aquatic Rehabilitation Program is working to address the human contributions to low dissolved oxygen problems in Hood Canal, using the scientific findings from the Hood Canal Dissolved Oxygen Program and others, to develop and advance corrective actions.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

C9.2 Clean up contaminated sites within and near Puget Sound.

This sub-strategy helps reduce the risk to humans and the Puget Sound ecosystem from toxic chemicals by cleaning up contaminated sites, focusing on contaminated sediment in the nearshore and contaminated upland sites near marine and freshwater. Sediment sites are contaminated with chemicals that have built up over time. These pollutants can enter the food chain and contaminate fish, shellfish, seals, orcas, and humans that eat the fish and shellfish. Sediment sites also contain contaminants that harm or kill the benthic community affecting the aquatic ecosystem and food sources of other animals. Contaminated sites along Puget Sound shorelines and in upland areas of watersheds also contribute to pollution in Puget Sound, since stormwater runoff from those sites can contain toxic chemicals and contaminants can leach into groundwater. Several regulatory programs govern the cleanup of contaminated sites, including the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, known as Superfund) for cleanup of hazardous waste sites and the Resource Conservation and Recovery Act (RCRA) governing the management and disposal of wastes, as well as the state cleanup program administered under the Model Toxics Control Act (MTCA) and the state Sediment Management Standards. Ecology is the primary regulatory agency that oversees sediment and upland cleanup efforts. Washington DNR, as the land manager, works cooperatively with Ecology on cleanup of state-owned aquatic lands.

Cleanup activities are made more effective and efficient by efforts to (1) integrate with source control (e.g., in agency water quality programs) to facilitate and protect investments in cleanup, and (2) link cleanup activities and habitat restoration efforts. This linkage can be accomplished through Shoreline Management Act (SMA) restoration plans, Natural Resource Damage Assessment actions, and Water Resource Inventory Area (WRIA) restoration actions. However, there are significant barriers to optimally integrating source control, cleanup, and restoration activities—for example, source control efforts on private property (e.g., private pipes that connect to sewer systems) tend to be limited, funding is very limited for SMA and WRIA activities (among other agency programs), and NRDA trustees can be resistant to accept habitat related to cleanup sites as creditable habitat for NRDA purposes.

The January 2012 draft Washington Integrated Climate Change Response Strategy includes the recommendation to incorporate future sea level rise in the prioritization, design, and post-project maintenance of shoreline toxic cleanup sites.

Since 1988, a total of 664 contaminated sites (both upland and sediment sites) have been cleaned up within a half mile of Puget Sound, including over 100 since the Puget Sound Initiative began in 2006. A specific emphasis has been placed on contaminated sediment sites in Puget Sound. Forty-four percent of the known contaminated sediment sites in Puget Sound have been cleaned up or reported cleaned up and 41 percent of contaminated sediment sites are in the process of being cleaned up.²¹ One hundred percent of publicly funded toxic site cleanups are currently on schedule, exceeding the 90 percent target. The number of cleanups that are completed each year has been declining over time, however. One contributor to this decline may be the reduced availability of private-sector funding to voluntarily clean up sites; another factor may be that sites have become more complex.

²¹ Information provided by Ecology Toxics Cleanup Program, September 2011.

One of the ways that contaminated sediment can be managed for cleanup and maintenance dredging is through the appropriate disposal of dredged material. Dredging supports site cleanup activities or other purposes, such as navigation and maritime commerce. The Washington Dredged Materials Management Program, an interagency program of the U.S. Army Corps of Engineers (Seattle District), EPA Region 10, Ecology, and Washington DNR, works to facilitate navigation and marine commerce while also protecting the aquatic environment. DNR manages and monitors 12 aquatic land disposal sites for dredged materials on state-owned aquatic land, including eight in Puget Sound and the Strait of Juan de Fuca. Statewide, annual volumes of dredged material disposal range from 120,000 cubic yards to over 1.5 million cubic yards. The program implements sediment sampling, chemical and biological testing, and test interpretation to evaluate the suitability of dredged material before approving it for in-water disposal.

Ongoing Programs

Major ongoing programs related to this sub-strategy include Ecology's Toxics Cleanup Program and EPA's cleanup programs including Superfund and RCRA. These programs include targeted work within the Puget Sound basin as well as base program cleanup activities that occur elsewhere around the state and nation. Funding for contaminated site cleanup comes from the federal Superfund program, the State and Local Toxics Control Accounts established by state law, and responsible parties. Efforts are underway to update the fish consumption rate used for state cleanups MCTA; this will result in changes to sediment cleanup and other standards.

One of initiatives highlighted in EPA's 2011–15 Strategic Plan is an Urban Waters effort in which the cleanup and reuse of contaminated land in urban watersheds is coordinated with regional water quality improvement efforts including TMDLs, CSO long term control plans, and green infrastructure to reduce stormwater pollution, thereby connecting source-control efforts with cleanup and restoration efforts. Ecology's Urban Waters Initiative, which originated with \$2.7 million in funding from the State Legislature in 2007, focuses specifically on addressing the contamination of three major urban waters—the Lower Duwamish and Commencement Bay in Puget Sound, as well as the Spokane River. Federal, state, tribal, and local cleanup activities are also occurring throughout the Puget Sound region, including major cleanup locations in Bellingham, Bremerton, and Elliott Bay and the Lower Duwamish Waterway in the Seattle area. In Bellingham Bay, for example, a partnership of 15 federal, state, tribal, and local stakeholders are working to expedite sediment cleanup, source control, and habitat restoration for cleanup sites around the bay through the Bellingham Bay Demonstration Pilot organized by Ecology in 1996. Ecology has also identified a series of "priority bays" for accelerated cleanup and restoration efforts for the Puget Sound Initiative, these include:

- Anacortes Area (Fidalgo/Padilla Bays)
- Budd Inlet
- Dumas Bay
- Everett Area (Port Gardner Bay)
- Oakland Bay
- Port Angeles Bay
- Port Gamble Bay

In recent years, funding set aside for the State and Local Toxics Control Accounts to support remediation and related activities has also been used to support other causes related to the general fund. For the

2011–13 fiscal biennium, for example, the state legislature specified that the Local Toxics Control Account could be used for shoreline update grants and actions for reducing public exposure to toxic air pollution; this means that there has been less money remaining to support site cleanup activities.

Key Ongoing Program Activities

- Performance measures for EPA include number of remedial action projects completed at Superfund National Priority List sites, number of Superfund remedial site assessments completed, number of brownfields properties cleaned up using brownfields funding (and other brownfields measures), and RCRA cleanup measures such as control migration of contaminated groundwater and complete construction of final remedies.
- Ecology continually evaluates reported contaminated sites and their priority for cleanup and restoration around Puget Sound. This includes an initial investigation and an assessment to determine the contaminated site's hazard ranking. As appropriate, Ecology will initiate cleanup planning, implementation, and monitoring activities for those contaminated areas as funding and resources are available.
- Ecology will continue to work with other organizations clean up and and restore contaminated sites located within one-half mile of Puget Sound. This includes the following "priority bays" for the Puget Sound Initiative: Anacortes Area (Fidalgo/Padilla Bays), Budd Inlet, Dumas Bay, Everett Area (Port Gardner Bay), Oakland Bay, Port Angeles Bay, and Port Gamble Bay. It also includes the following other major Puget Sound cleanup locations: Bellingham Bay, Bremerton area (Port Washington Narrows), Elliott Bay, and Lower Duwamish Waterway. Ecology will consult with DNR regarding cleanup activities on state-owned aquatic lands. Ecology will also ensure that these and other cleanup sites within the Puget Sound area have post-construction monitoring plans in place that provide data on the effectiveness of the cleanup remedy.
- Maintain adequate funding to assure continued, timely cleanup and remediation of toxic sites. Assure that funding to Ecology provides an appropriate level of state match to approved Remedial Action Grant projects and that the LTCA is protected for its intended statutory purposes.

Near-Term Actions

None; work in the near-term will focus on implementation of ongoing programs.

C9.3 Restore and protect water quality at swimming beaches and recreational areas.

Swimming in water contaminated with pathogens and other pollutants can cause illness in humans, as can contact with contaminated water through water-based recreational activities such as surfing, paddle boarding, kayaking, kite boarding, and scuba diving. Water at beaches can be contaminated by fecal matter, which can contain harmful bacteria, parasites, and viruses. Sources of contamination vary and include improperly disposed diapers or animal waste, stormwater runoff containing human or animal waste, malfunctioning septic systems or sewage treatment plants, CSOs, and wildlife (issues with agricultural runoff, stormwater pollution, on-site sewage systems, and centralized wastewater treatment systems are discussed in strategies C3–C6). Marine waters can be contaminated through pollution carried by freshwater streams as well as through other pathways. While swimming beaches are most often used by bathers during warmer months of the year, other popular water-based recreational activities like surfing, scuba diving, and kite boarding occur throughout the year in Puget

Sound. As noted in the Challenge ~~passage-section~~above, 26 percent of monitored marine beaches in Puget Sound failed to meet water quality standards in 2010, and others have failed to meet the standards in some of the last few years.

Additional funding is needed to create and implement a freshwater swimming beach monitoring and notification program in the Puget Sound region. Today, only six of 39 counties throughout the state monitor bacteria at freshwater swimming beaches. These locally-funded programs provide information to the public regarding health at public swimming beaches. Over the past few years, cities and counties have discontinued these programs due to lack of funding.

Ongoing Programs

Ecology's and EPA's water quality programs, including the programs to develop and implement TMDL studies, state and federal water quality financial assistance programs, and state and local non-point source control programs are key ongoing programs that advance this sub-strategy. Under the TMDL program, Ecology completes a Water Quality Assessment for EPA every two years that produces a list of water bodies (called a 303(d) list) that do not meet water quality standards. In 2010, this assessment focused on marine waters, and in 2012 the assessment will focus on fresh water. The DOH- and Ecology-administered BEACH program, as noted above, is the primary state program for monitoring and notification of water quality contamination at marine beaches.

Beach Environmental Assessment, Communication, & Health Program

Ecology and DOH jointly administer the Beach Environmental Assessment, Communication, & Health (BEACH) program to protect people who enjoy Washington's saltwater beaches. The BEACH program monitors marine beaches for fecal bacteria, notifies the public when the results are high, and educates the public on how to avoid getting sick from playing in saltwater. There is no comparable statewide program for freshwater beaches; however, local public health agencies may have their own programs for freshwater areas. This sub-strategy helps ensure that swimming and other contact recreational activities in both marine and fresh waters in Puget Sound does not pose risks to human health. It provides for corrective actions to address pollution problems that cause swimming beaches and other contact recreation areas to not meet water quality standards for pathogens or other forms of contamination.

Near-Term Actions

C9.3 NTA 1: Freshwater Swimming Beach Program. By 2014, Ecology and DOH will develop a proposal to coordinate a monitoring and notification freshwater swimming beach program for the Puget Sound region.

Performance measure: To be determined.

C9.3 NTA 2: Correct Pollution Problems at Marine Beaches. Ecology and DOH will develop a plan to conduct pollution source surveys and correct pollution problems at marine beaches used for swimming, surfing, diving and other recreational uses. Ecology and DOH will coordinate with local, state and tribal programs that address point source and nonpoint source pollution to assure that activities are not duplicative

Performance measure: A priority list will be developed and 10 shoreline surveys completed by June 30, 2013 and 10 additional shoreline surveys completed by June 30, 2014.

In addition, near-term actions to address wastewater pollution, a key source of contamination of swimming beaches, are discussed in strategies C5–C6.8. Sub-strategies C9.1.1 (covering TMDLs) and C9.1.4 (covering local and tribal pollution identification and control programs) also are very important for addressing water quality and public health issues at swimming beaches and recreational areas.

C9.4 Develop and implement local and tribal pollution identification and correction programs.

Local agencies and tribes across Puget Sound implement pollution identification and correction (PIC) programs to determine the causes and sources of nonpoint water pollution in specific geographical areas, and to take corrective actions to address the pollution sources, such as outreach and education, technical assistance, incentives for best management practices, and enforcement. For example, the Kitsap County Health District's PIC program, which is funded by the County's Surface and Stormwater Management program and grants from Ecology, developed a 2010 priority area work list to identify priority PIC project locations to address bacterial water pollution, thereby protecting public health, protecting shellfish resources, and restoring surface water quality. This sub-strategy helps ensure that Puget Sound marine and freshwaters support aquatic life and provide for other beneficial uses by ensuring that pollution sources are identified and corrective actions are taken to address problems. These activities are closely associated with state requirements for local health jurisdictions to carry out comprehensive plans to ensure that on-site sewage systems are properly managed to protect public health and sensitive waters; sub-strategies and actions related to on-site sewage systems are further discussed in strategy C5.

Ongoing Programs

With funding from EPA available from November 2011 through September 2014, DOH and Ecology are offering grants to county governments, local health jurisdictions, and tribal governments adjacent to Puget Sound to establish or enhance PIC programs to identify and address pathogen and nutrient pollution from a variety of nonpoint sources, including on-site sewage systems, farm animals, pets, sewage from boats, and stormwater runoff. Although this grant opportunity is focused on pathogens, PIC programs can also be an important way that local communities can monitor and protect against other pollutants, including toxic chemicals. The goal with federal funding of PIC programs is support for the establishment and/or enhancement of programs that can eventually be sustainable programs that integrate across various local water quality programs, interests, and concerns. Local and tribal water quality improvement programs funded from utility fees, Ecology and EPA's water quality programs, and other water quality financial assistance may have similar objectives of identifying and addressing water pollution issues.

Key Ongoing Program Activities

- Local jurisdictions and tribes will establish or enhance PIC programs to identify and address pathogen, nutrient, and toxic pollution problems in specific geographical areas that may arise from a variety of sources, including on-site sewage systems, stormwater runoff, agricultural

sources, and other nonpoint sources. Grant funding available through 2014 can help these agencies to design programs that integrate across multiple local water quality interests.

- Ecology will continue to provide guidance and financial assistance to local governments to establish and carry out PIC programs.

Near-Term Actions



C9.4 NTA 1: Pollution Identification and Correction Programs. DOH and Ecology, in collaboration with EPA and counties, will create sustainable pollution identification and correction programs (PIC) that are designed to improve and protect water quality.

Performance measure: Award PIC funds and distribute Agricultural BMP funds to at least six Puget Sound counties by July 2012. Metric for each program will be individually set to reflect targets for numbers of BMPs implemented and maintained and systems repaired to address water quality.

C9.4 HC 3: Hood Canal PIC Program. By April 2014, HCCC will complete Phase I of a regional Hood Canal Pollution Identification and Correction program to determine the needs for a comprehensive regional program and advance funding proposal(s) for implementation.

Performance measure: April 2014, complete Phase 1. Results of this Phase I approach will allow development and implement of the regional program during Phase II slated for 2014 and beyond.

C9.4 WS 8: West Sound Septic System Repairs Using PIC. Kitsap Public Health will report on the number of failing septic systems identified using PIC methodology, the number repaired and associated improvements in water quality by December 2013.

Performance measure: Number of failing septic systems identified using PIC methodology, the number repaired and associated improvements in water quality by December 2013.

Emerging Issues and Future Opportunities

Specific longer-term activities to address Puget Sound water quality impairments that were identified during the Action Agenda update process include the following:

- **Microplastics.** There is increasing evidence of plastic pollution in Puget Sound marine and nearshore areas.²² Plastics have the potential to strangle marine wildlife. Mammals, birds, and fish also ingest small microplastics and the toxics they contain. The Strait ERN for the Strait Action Area has identified a priority action led by the Port Townsend Marine Science Center for microplastics (as part of a “toxic source reduction programs” priority strategy). Ecology will work with the Port Townsend Marine Science Center and other partners to continue to assemble information on plastics pollution and microplastics, including any data specific to Puget Sound, and will recommend actions to (1) better understand the threats to Puget Sound, and then (2) address the highest priority problems.

²² Since 2006, the Port Townsend Marine Science Center, with funding from a 2007 grant from Ecology, has led a Plastics Project examining plastics contamination in the Puget Sound region; this has included a sampling effort at over 30 beaches in 12 counties and a gull bolus study.

- **Incentives and Binding Mechanisms for Reducing Pollution from Non-point Sources.** Ecology, EPA, and local organizations will confer on possible incentives and/or binding mechanisms for ensuring that non-point pollutant reductions strategies called for in TMDLs are actually implemented for high priority TMDLs.
- **Dredged Materials Management.** The Dredged Materials Management Program (DNR, Ecology, EPA Region 10, and U.S. Army Corps of Engineers Seattle District) will continue to update standards, sampling and analysis protocols, and risk assessment procedures based on best available science through the Sediment Management Annual Review Meetings. Stakeholders have identified the need for additional analysis of dioxins in disposed material.
- **Interagency Coordination.** Ecology, DNR, WDFW, and other agencies will seek to remove barriers and conflicts between programs with similar goals—including the MTCA and NRDA cleanup programs and the SMA and WRIA restoration efforts—to facilitate improved integration of habitat restoration and cleanup activities in and near Puget Sound. This will include examining whether NRDA credits can be more easily obtained for work completed under other restoration programs.
- **Local Funding.** State & local agencies should collaborate to develop sufficient, stable funding for local governments to implement PIC programs, implement actions called for in TMDLs, and undertake other efforts to improve water quality.
- **Cleanup Program Evaluation and Improvements.** Stakeholders have suggested (1) an analysis of how interim cleanups have been used in the past, including whether they have slowed or sped up the pace of entire cleanup, and/or have influenced the cleanup decision and (2) evaluating how to better implement public participation and include all stakeholders in the early stages of clean ups.
- **Viruses in Wastewater Discharges.** The Department of Health will evaluate the application of male specific coliphage (MSC) for use in the management of shellfish harvest areas affected by raw or partially untreated sewage discharges from wastewater treatment plants or community sewage collection systems. This supplements work by the US Food and Drug Administration to develop a reliable viral risk indicator and to evaluate if virus uptake and persistence are different in Puget Sound than other areas of the country. This research could help better evaluate when to open shellfish harvest sites after a transient pollution event and to better delineate Prohibited areas where there is chronic pollution. In addition, this research could help better understand the efficiency of various wastewater treatment systems to inactivate/remove enteric viruses prior to discharge.
- **Predict Pathogens to Protect Public Health.** The Department of Health will use their 2012-2013 Hershman Fellow to assist the University of Washington and NOAA's Northwest Fisheries Science Center to identify environmental criteria to develop and implement a predictive model for *Vibrio parahaemolyticus*, a naturally occurring bacteria that can make people sick from eating raw oysters. The model would help us take action where problems occur and ultimately prevent illnesses.
- Future sea level rise should be considered in the prioritization, design, and post-project maintenance of clean-up sites near the shoreline.

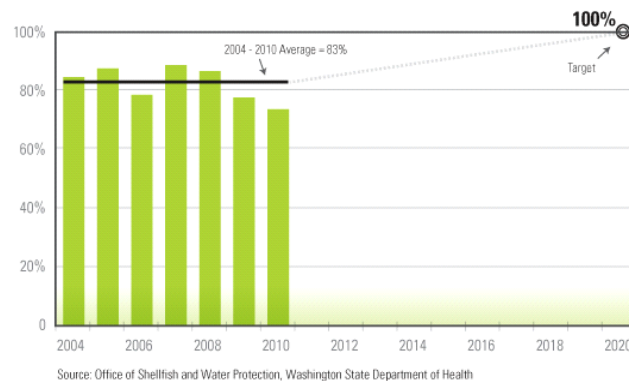
Target View: Swimming Beaches

The 2020 target for swimming beaches is that all monitored beaches meet standards for a type of fecal bacteria called enterococcus. Fecal bacteria are found in human and animal waste. These contaminants can enter the water through a variety of means, including leaky or inadequate septic systems, wastewater treatment overflows, boat and vessel discharges, and stormwater contaminated by pet and animal waste. Controlling these sources of pollution is the key to improving water quality at swimming beaches.

Luckily, many of Puget Sound's swimming beaches already meet high standards for clean water – almost half of routinely monitored beaches consistently met the standards between 2004 and 2010; another third met the standard except for one or two years. At the same time, there is room for improvement. In any given year from 2004 - 2010, 7 to 15 beaches failed to meet standards, resulting in the issuance of health advisories to the public.

Many strategies and actions will work together to better control pollution and thereby improve water quality at swimming beaches. The basic chain of events is to identify sources and potential sources of pollution to swimming beaches, assess these sources and improve the consistency and efficacy of pollution controls which will, in turn, improve water quality. Key strategies and actions related to this work include:

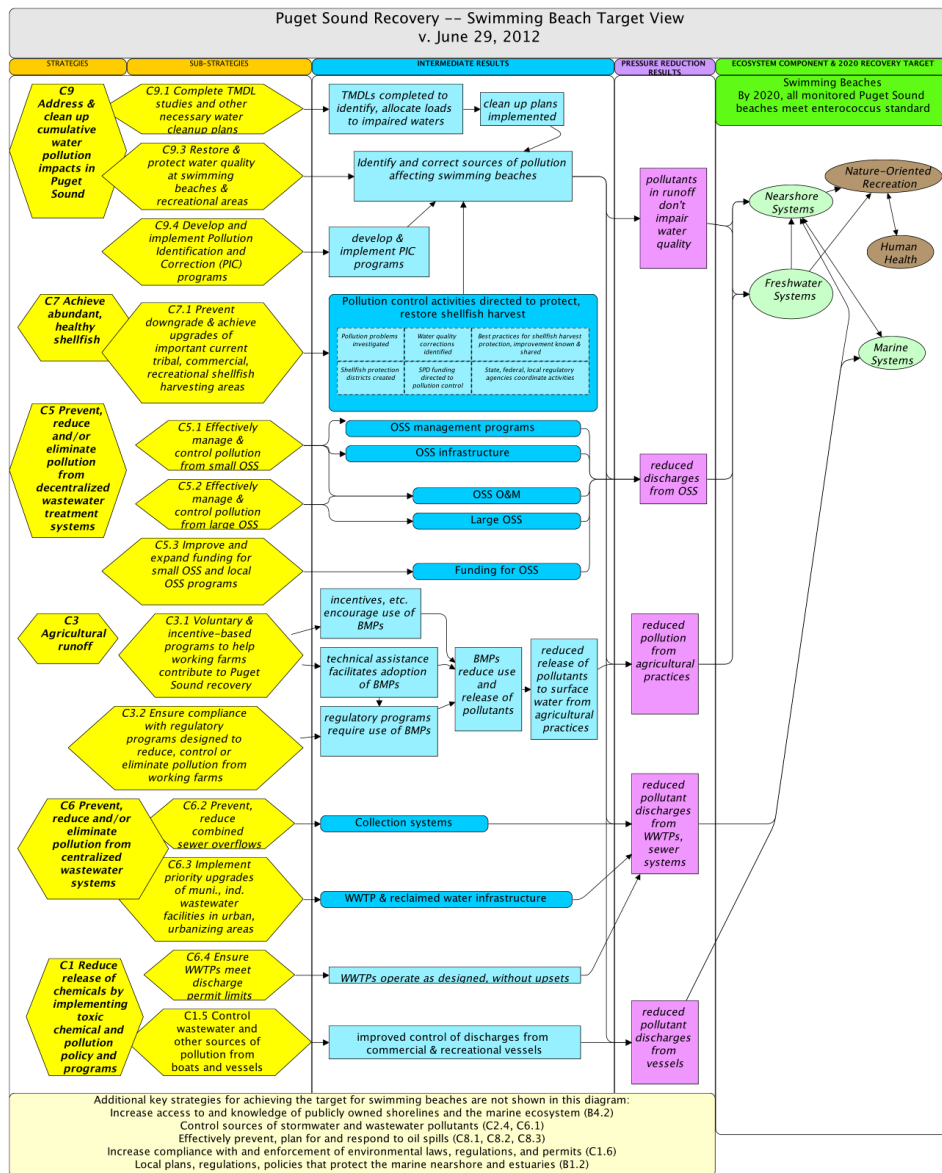
Percent of Monitored Swimming Beaches Meeting Water Quality Standards
Annual, 2004-2020



Percent of Puget Sound marine swimming beaches meeting water quality standards for healthy human use, allowing for one exception per swimming season. In general, samples are collected weekly. The basic measure is for enterococcus, but fecal coliform bacteria and E. coli are also sampled if warranted.

- Address and clean up cumulative water pollution impacts in Puget Sound (C9.1, C9.3, C9.4)
- Increase access to and knowledge of publicly owned Puget Sound shorelines and the marine ecosystem (B4.2)
- Prevent problems from new development (C2.4)
- ~~Manage~~ Prevent, reduce, and control agricultural runoff (C3.2, C3.1)
- Prevent, reduce and/or eliminate pollution from decentralized wastewater treatment systems (C5.2, C5.3, C5.1)
- Prevent, reduce and/or eliminate pollution from centralized wastewater treatment systems (C6.2, C6.4, C6.3, C6.1)
- Effectively prevent, plan for and respond to oil spills (C8.1, C8.2, C8.3)
- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.6, C1.5)
- Support local governments to adopt and implement plans, regulations, and policies that protect the marine nearshore and estuaries, and incorporate climate change forecasts (B1.2)
- Improve water quality to prevent downgrade and achieve upgrades of important current tribal, commercial and recreational shellfish harvesting areas (C7.1)

The results chain, or logic model, below illustrates how strategies and sub-strategies lead to water quality improvements at swimming beaches. The yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the swimming beach target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.



Target View: Fresh Water Quality

Clean water is vital to people and key to healthy fish and wildlife populations. But when our rivers and streams pick up pollutants, toxic contaminants, or excessive sediments and nutrients, it not only affects the health of our watersheds, but impacts our marine waters, swimming beaches, and shellfish beds as well. Our fresh waters should be safe for drinking and swimming, able to support farms, fish, and wildlife, and not harm our beaches, shellfish beds, or marine waters.

Walk along a small stream or creek in the region, and on the rocks and sediments of the streambed you may find a lively community of aquatic insect larvae, snails, and other small invertebrates. These small creatures thrive in clean, cool waters and form a critical part of the aquatic food chain. But this unique biological community is sensitive to many things, including pollution and runoff from agricultural and developed lands, reduced water levels and high temperatures in the summer, and the clearing of trees and vegetation along streambanks. Scientists often measure the condition of the aquatic community as an indicator of overall water quality and stream health.

Three 2020 recovery targets were established for fresh water quality:

- At least half of all monitored streams should score 80 or above on the fresh water quality index
- Reduce the number of “impaired” waters
- Protect (i.e. allow no degradation of) any small streams that are currently ranked “excellent” for biological condition, and improve water quality in streams ranked “fair” so their average scores become “good”

Scientists who monitor our streams and rivers have developed an index of fresh water quality. A score of 80 or higher (out of 100) indicates that water quality is generally meeting our goals for sediments, nutrients, temperature, dissolved oxygen, fecal coliform bacteria, and other conventional pollutants (the index does not address toxic contaminants for a number of technical reasons). In general, fresh water quality index scores for the major rivers in Puget Sound have slowly improved since the index was first established in 1995 and now average in the mid-70's range. Scores in small urban streams are lower.

Water Quality Index

Annual, 2000-2010

Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg
Duckabush	93	95	94	90	74	94	89	85	88	96	86	89
Elwha	86	88	83	76	73	74	86	67	66	81	81	78
Skokomish	95	95	94	85	70	67	92	89	89	94	86	87
Snohomish	92	91	89	81	74	75	89	75	81	85	79	83
Borderline	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg
Cedar	87	76	60	78	72	84	81	79	79	81	77	78
Upper Skagit	87	86	59	85	64	81	84	75	75	81	56	76
Lower Skagit	89	91	71	76	61	73	77	77	75	76	74	76
Deschutes	62	72	70	73	61	83	88	88	83	76	74	75
Nisqually	40	60	79	79	69	71	74	75	91	74	83	72
Not Meeting Goals	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg
Green	82	73	66	67	75	49	72	68	60	69	63	68
Nooksack	65	68	58	57	52	54	61	51	60	69	56	59
Puyallup	60	58	57	55	51	58	59	58	61	49	62	57
Samish	86	75	32	49	34	71	67	74	59	80	63	63
Stillaguamish	81	60	44	72	55	67	71	69	75	75	71	67

Source: River and Stream Ambient Monitoring Program, Washington State Department of Ecology

The Water Quality Index (WQI) is an aggregation of monthly measurements of typical water pollutants reported on a scale of 1 to 100. A higher number indicates better quality. An index score of 80 or above indicates that water quality is generally meeting our goals; between 70 and 80 is considered "fair" or "borderline"; 40-70 is failing to meet water quality goals and less than 40 is "poor".

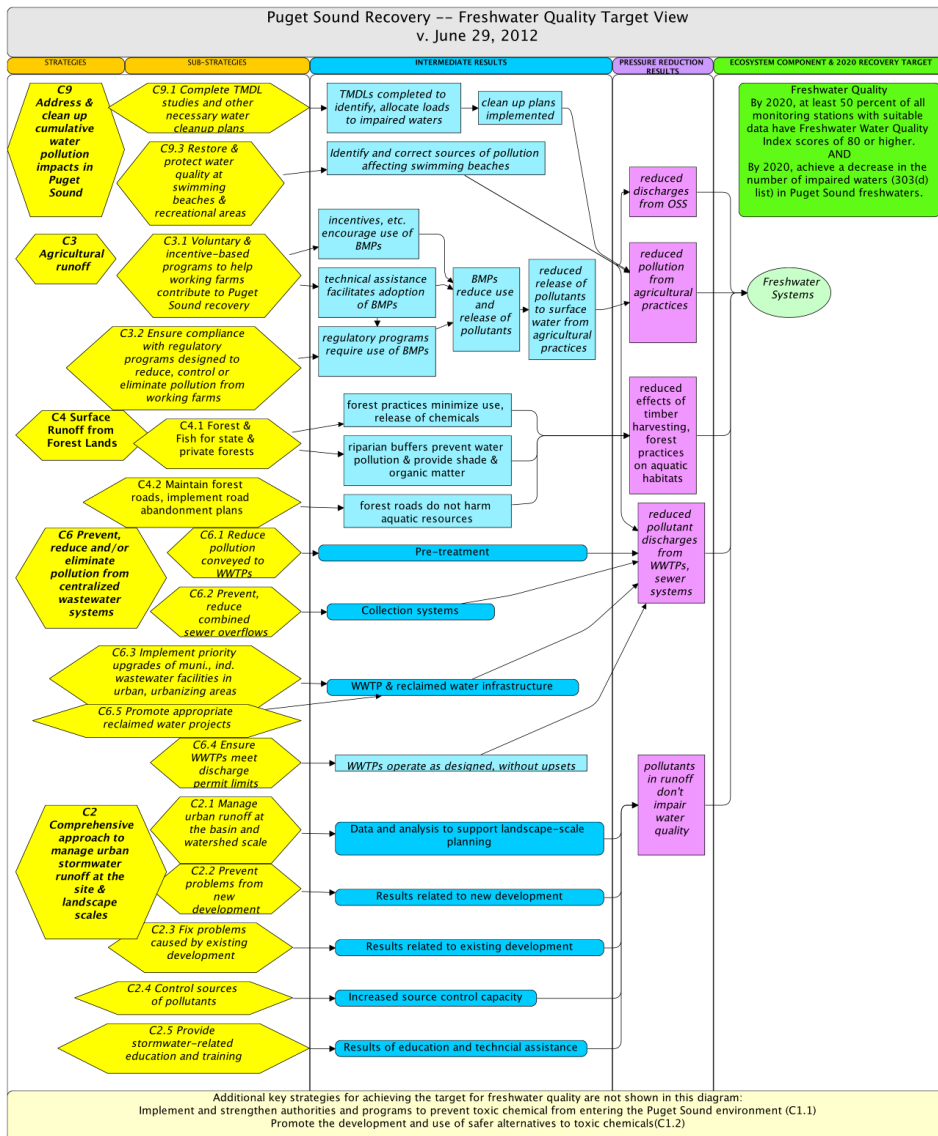
Stations meeting water quality goals are all in the relatively undeveloped Olympic Peninsula (except for the Snohomish River). Stations not meeting water quality goals tend to be in watersheds with more people and more agricultural development.

The Action Agenda strategies most related to the fresh water quality target are:

- ~~Manage-Prevent, reduce, and control~~ agricultural runoff (C3.2, C3.1)
- ~~Manage-Prevent, reduce, and control~~ surface runoff from forest lands (C4.2, C4.1)
- Prevent, reduce and/or eliminate pollution from centralized wastewater treatment systems (C6.1, C6.2, C6.4, C6.3, C6.5)
- Address and clean up cumulative water pollution impacts in Puget Sound (C9.32, C9.1)
- Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales (C2.5, C2.4, C2.1, C2.3, C2.2)
- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.1, C1.26)
- ~~Use integrated market-based programs, incentives, and ecosystem markets to steward and conserve private forest and agricultural lands (A3.1)~~

The results chain, or logic model, below illustrates how strategies and sub-strategies lead to fresh water quality improvements. The yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the fresh water target. Arrows to

the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.



Target View: Marine Sediment Quality

In a healthy, well-functioning estuary, marine sediments support an important and healthy biological community. But in Puget Sound and many estuaries around the world, sediments have become contaminated with toxic chemicals from industrial discharges, contaminated run-off from urban streets and roads, discharges from wastewater treatment plants, agricultural and forest chemicals carried down rivers and streams, oil spills, and even chemicals carried long-distances through the atmosphere that eventually fall out of the sky with our rain. As the forests around Puget Sound have been logged, streams and rivers channelized, and towns and cities built up, the amount, rate, and quality of sediment deposited into Puget Sound has changed dramatically.

A functioning, resilient ecosystem includes sediment quality that supports functioning, healthy communities of sediment dwelling invertebrates. The 2020 recovery target for marine sediment quality is:

By 2020, all Puget Sound regions and bays should:

- Have sediment chemistry measures reflecting "minimum exposure", as defined by having a Sediment Chemistry Index (SCI) score of >93.3.
- Have combined measures of sediment chemistry, toxicity, and the health of bottom-dwelling marine life (i.e., the benthos) reflecting "unimpacted" conditions, as defined by having a Sediment Quality Triad Index (SQTI) score of >83.
- Have no chemistry measurements exceeding the Sediment Quality Standard values set in Washington State

All eight regions of Puget Sound monitored from 1997-2009 demonstrated minimum exposure to toxic chemicals in sediment. Four of eight regions demonstrated unimpacted benthic invertebrate communities. The other four regions demonstrated likely impacted communities; the target for "unimpacted" benthos in all regions is not met.

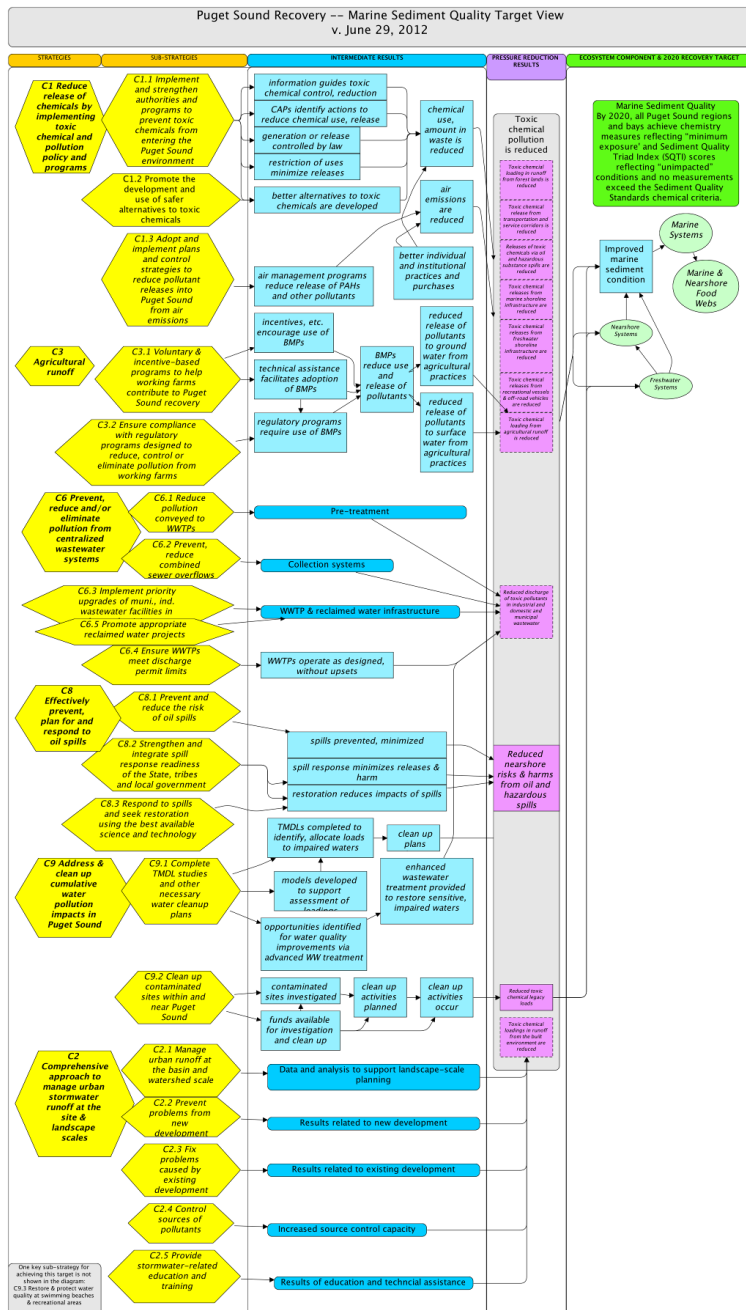
Two of four Puget Sound urban bays monitored from 1998-2010 demonstrated minimum exposure to toxic chemicals in sediment. The other two urban bays that have been monitored showed improving chemistry index scores but low levels of exposure. Benthic community results are available for only three urban bays: One appears unimpacted, one has likely impacted communities and the third is on the border of unimpacted-likely impacted. According to both chemistry and benthos measures, the targets are not met in all urban bays.

The Action Agenda strategies related to achieving the recovery target for marine sediment quality are:

- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.3, C1.1, C1.2)
- Prevent, reduce, and control agricultural runoff (C3.1, C3.2)

- Prevent, reduce and/or eliminate pollution from centralized wastewater systems (C6.1, C6.2, C6.4, C6.3, C6.5)
- Effectively prevent, plan for and respond to oil spills (C8.1, C8.2, C8.3)
- Address and clean up cumulative water pollution impacts in Puget Sound (C9.2, C9.1, C9.3)
- Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales (C2.5, C2.4, C2.1, C2.3, C2.2)

In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery targets.



Target View: Toxics in Fish

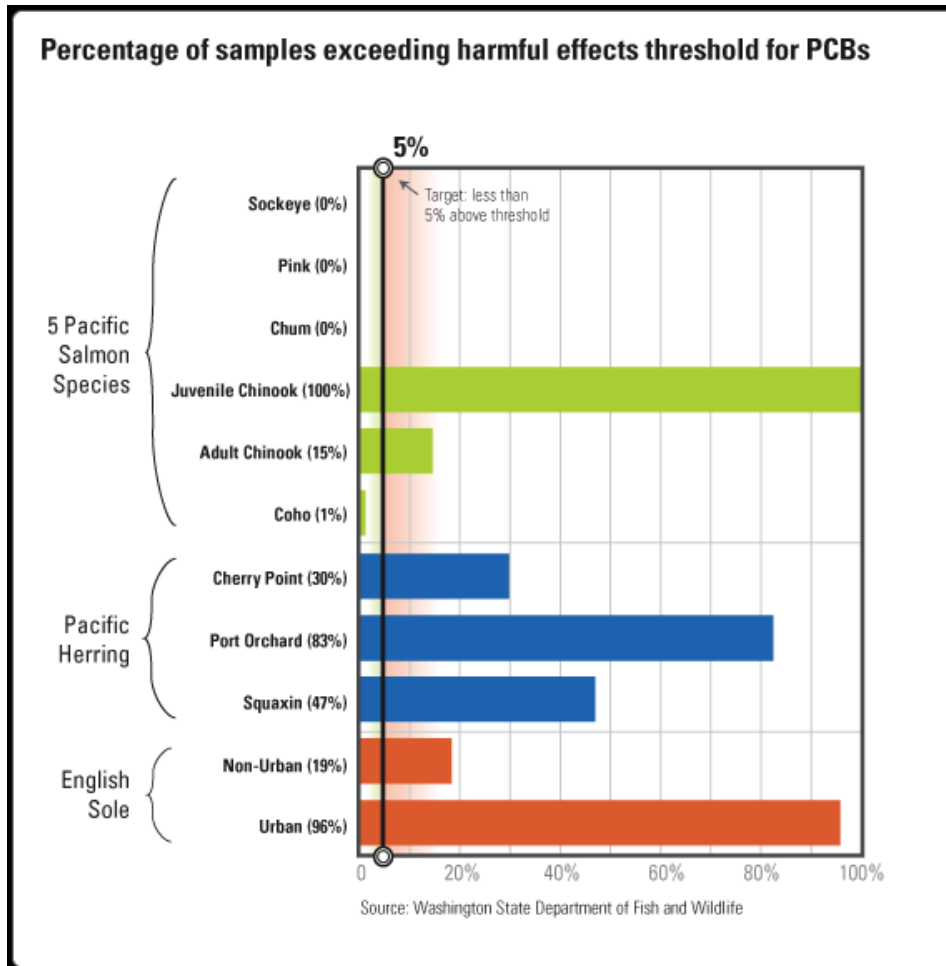
Toxic pollutants in Puget Sound bays, rivers and streams can show up in native fish, causing them to become diseased and posing a health threat to humans if consumed. One of the most worrisome pollutants in the Puget Sound ecosystem is a group of chemicals called PCBs (polychlorinated biphenyls). Concern over these chemicals in Puget Sound is high because they are toxic, they last for a long time in the ecosystem, and their levels increase in predators as the chemicals move up the food chain. Measuring these pollutants in fish tissues tells us whether present-day levels are harmful to the fish or the predators that consume them, and whether they are safe for us to eat.

PCBs were originally used in many industrial applications, but many of these uses were banned in the US in the 1970s. Although PCB levels have decreased in some fish since then, they remain high in certain areas and species. In Puget Sound, PCBs are high in bottom fish that live near urban or industrial areas with contaminated sediments. Surprisingly, PCBs are also high in many species from Puget Sound's pelagic, or open-water food web, including herring, salmon, seals, and orcas. Exposure to PCBs may be harming these species, and concern for human health from this contamination has led the Washington Department of Health to issue consumption advisories for some Puget Sound salmon and bottom fish. Scientists have been tracking PCBs and other chemicals in Puget Sound fish since 1989, and have established threshold limits for these chemicals in fish tissues. These thresholds provide a guideline for the level of toxic chemicals that fish can tolerate, before they become diseased or show other harmful effects, or that presents elevated levels of risk to humans consuming these fish.

There is a suite of individual targets that together comprise the recovery target for toxics in fish. They are:

- Reducing levels of PCBs and related compounds in salmon, herring, and English sole (a bottom-dwelling flatfish) below:
 - a threshold related to fish health, and
 - a threshold related to human health.
- Reducing concentrations of two other classes of toxic contaminants (abbreviated as PAHs and EDCs), in herring and English sole below several different thresholds for harmful effects in fish.

Current data on contaminants in Puget Sound fish is displayed in the graph below.



Average concentration of PCBs as a summation of congeners, compared to a tissue threshold of 2400 ng PCBs/g lipid. English sole data from 2007, 2009, n=137; herring data from 2007-2010, n=70; Coho data from 2006, 2008, n=86; adult Chinook data from 2003, 2004, n=48; juvenile Chinook data from 2010, n=5; pink, chum, and sockeye salmon data from 2003, 2004, n=5 each.

The Action Agenda strategies most related to achieving the recovery target for toxics in fish are:

- Prevent, reduce, and control the sources of contaminants entering Puget Sound (C1.3, C1.1, C1.2)
- Prevent, reduce, and control agricultural runoff (C3.1, C3.2)
- Prevent, reduce and/or eliminate pollution from centralized wastewater systems (C6.1, C6.2, C6.4, C6.3, C6.5)
- Effectively prevent, plan for and respond to oil spills (C8.1, C8.2, C8.3)

- Address and clean up cumulative water pollution impacts in Puget Sound (C9.2, C9.1, C9.3)
- Use a comprehensive approach to manage urban stormwater runoff at the site and landscape scales (C2.5, C2.4, C2.1, C2.3, C2.2)

In the following results chain, or logic model, yellow polygons identify strategies and sub-strategies from the Action Agenda that we believe will contribute significantly towards meeting the target. Arrows to the blue boxes describe the intermediate results the strategies and actions are expected to achieve. The purple boxes show the reduced pressure on the ecosystem that is expected to occur, the green ovals show the areas of the ecosystem where the change will be observed, and the dark green square shows the recovery target.

